From Home To Operation (FHTO) – a preoperative process

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From Home To Operation (FHTO) – a preoperative process

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nee Keränen

Academic Dissertation

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To my grandparents

CONTENTS

1. LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following original publications, referred to in the text by their Roman numerals:

I Keränen J, Soini EJO, Ryynänen OP, Hietaniemi K, Keränen U. Economic evaluation comparing From Home To Operation same day admission and preoperative admission one day prior to the surgery process: a randomized, controlled trial of laparoscopic cholecystectomy. Cur Med Res Opin 2007;23:2775-84.

II Keränen J, Keränen U. From Home To Operation (FHTO) – a new surgical admission centre: does the comprehensive initialisation of a new process harm surgery outcome. Scan J Surg 2011;100:136-40.

III Laisi J, Tohmo H, Peltonen E, Keränen U. Criteria based anaesthesia preoperative evaluation clinic in a From Home To Operation same day admission process – six months after the implementation. (Submitted)

IV Laisi J, Tohmo H, Keränen U. Surgery cancellation on the day of surgery in same day admission in a Finnish hospital (accepted for publication, Scan J Surg).

2. ABBREVIATIONS

15D	15 dimensions health-related quality of life questionnaire
APEC	Anaesthesia preoperative evaluation clinic
ASA	American Society of Anesthesiologists
ASA status	American Society of Anesthesiologists Physical Status
ASO	Arteriosclerosis obliterans
BMI	Body mass index
CEA	Cost-effectiveness analysis
CI	Confidence interval
COPD	Chronic obstructive pulmonary disease
CUA	Cost-utility analysis
FHTO	From Home to Operation
HRQoL	Health-related quality of life
LC	Laparoscopic cholecystectomy
OR	Operation room
ORL	Otorhinolaryngology
SD	Standard deviation
SSI	Surgical site infection
UTI	Urinary tract infection
QALY	Quality adjusted life years

3. ABSTRACT

The dilemma of an increasing patient load but limited resources creates a need for process rationalizing in health care. The From Home To Operation (FHTO) (Leikkaukseen kotoa (LEIKO) in Finnish), was designed to respond to this demand. In the FHTO process, the patients are admitted on the morning of operation through a specialised preoperative unit regardless of the possible postoperative need for hospitalisation. The facilities are located immediately adjacent to the operation rooms, and the process is the same for all surgical patients on the day of operation. To maintain the anaesthesia safety in the process, some of the patients need to be referred to an anaesthesia preoperative evaluation clinic (APEC) according to predefined criteria. The aims of the study were to investigate the same day admission FHTO process, especially focusing on the health-related quality of life (HRQoL), the effect of process transition on surgery outcome, the role of anaesthesia preoperative evaluation clinic, and the rates and reasons for surgery cancellation.

To evaluate the HRQoL in the FHTO process, 47 patients were randomised to undergo laparoscopic cholecystectomy (LC) via either the FHTO or the traditional process (Study I) in the Hyvinkää Hospital of the Hospital District of Helsinki and Uusimaa. The HRQoL, length of stay and postoperative outcomes were registered and analysed. The effect of the process transition on the surgery outcome was assessed in 592 patients who underwent an elective surgical procedure in the Hyvinkää Hospital six months before new FHTO unit, and in 616 patients six months after the transition (Study II). Patient baseline and postoperative characteristics, as well as total length of stay were compared between these two groups. The APEC was initialised at the same time with the new FHTO unit. The preoperative baseline characteristics and postoperative outcome were compared between 152 patients who were assessed at the APEC prior to surgery and 462 patients who were not assessed (Study III). Data of all scheduled surgeries with FHTO admission within two years of time were analysed. The total cancellation rate, cancellation rate per speciality and reasons for cancellation were studied (Study IV).

The postoperative HRQoL of patients in the FHTO process improved in many dimensions, whereas for those in the traditional process, it mainly remained at the preoperative level (Study I). The dimension vitality improved significantly in the FHTO process. The length of hospital stay was shorter, and significantly more quality adjusted life years (QALYs) were gained in the FHTO process than in the corresponding traditional process. The mean length

of hospital stay decreased after implementation of the new FHTO unit (Study II). Simultaneously, the proportion of elective surgical operations performed on the day of admission through the FHTO unit increased from 54% to 90.5%. No significant changes in the surgical outcome were observed. Only 24.8% of elective surgical patients were referred to the APEC evaluation (Study III), and of these patients, 67.6% had ASA class III or IV, and 63.8% had two or more additional health issues. They also had a longer mean operation time, and experienced greater perioperative blood loss than patients who were not evaluated at the APEC prior to surgery. The rates of postoperative complications were similar in both of these patient groups. The surgery cancellation rate was 4.5% in the FHTO process (Study IV). The highest rates were encountered in hand surgery (8.2%) and in orthopaedic surgery (5.4%). The majority, 72.4%, of all cancelled operations were related to patient-related reasons. The most common single reason for cancellation was that the operation was no longer necessary.

The same day admission process FHTO improved the postoperative HRQoL compared to the traditional surgical process. The mean hospitalisation time was shorter in the FHTO process, but postoperative complication rates remained unchanged. Over 90% of all elective surgical patients were admitted on the morning of the operation without any preoperative visit to the surgical ward. Only the most severly ill patients required a preoperative anaesthesia evaluation. The predefined criteria for the APEC consultation were sufficient for identifying the most difficult cases, although further studies with specific patient groups are needed. The overall cancellation rate in the FHTO process was at a reasonable level, however, it could still be reduced. The most common reason for surgery cancellation was that the operation was no longer necessary, with the hand- and orthopaedic specialities exhibiting the highest cancellation rates. The indications for surgery need to be explicit if one wishes to avoid unnecessary cancellations. The intention should be to admit elective patients on the morning of the operation without any preoperative visit to the surgical ward. The preoperative processes should be developed as a whole, and the traditional process allowed to pass into history.

4. INTRODUCTION

The From Home to Operation (FHTO) same day admission process was developed to respond to the dilemma of increasing patient loads and limited resources in the field of surgery. The discrepancy between the ever increasing treatment possibilities on one hand and the finite available resources on the other is the stimulus for process development in public health care.

The surgical approach to the treatment of illness includes three phases: preoperative planning and preparation, perioperative induction of anaesthesia and the actual surgical procedure, and postoperative treatment and recovery. Preoperative planning and preparation are the key for a successful surgical practice. The indications for surgery have to be properly defined and the patient´s health status needs to be optimised before surgery in order to achieve the best possible outcome. Traditionally, patient optimising and preoperative preparations have been conducted in an inpatient ward before surgery (Calligaro et al. 1995).

There have been major advances in surgical processes aiming to decrease the length of hospital stay and these have been achieved without any increase in morbidity and mortality (Boothe and Finegan 1995, Kehlet 2006). The main reason for decreasing the length of stay is cost reduction. However, decreasing the postoperative length of stay by one day can achieve a mere 3% cost reduction in the total hospitalisation costs (Taheri et al. 2000). Consequently, the emphasis should be on process development of the early stages of admission. Day surgery has been intented for patients who may be discharged on the day of the operation (Jarret and Staniszewski 2006). However, the preoperative admission to a surgical ward of patients requiring postoperative care at the hospital has not been widely questioned in public health care.

In many same day admission processes, the patients are either admitted into a ward or to a separate admission area, from where they are transferred to the operation room (OR) (Calligaro et al. 1995, Pollard et al.1996). Day surgery is usually arranged in its own unit which is separate from other surgical facilities (Jarret and Staniszewski 2006, Mattila et al. 2009). An anaesthesia preoperative evaluation clinic (APEC) is used for evaluating and optimising patient health status before surgery and is also used to prevent day of surgery cancellations in the same day admission processes (Fischer 1996, van Klei et al. 2002). In

different reports, the proportion of patients being referred to the APEC consultation, has varied from a small proportion to the majority of patients (Lemmens et al. 2006).

In the FHTO process, only a minority of patients are designated for the APEC consultation. On the day of operation, all patients are admitted through a specialised unit directly to the OR. The unit is located adjacent to the operation room, and patients walk with a member of the operation team to the OR without visiting any surgical ward. The process and facilities are the same for all elective surgical patients regardless of the need for postoperative hospitalisation or the possibility of discharge on the day of operation.

The aims of this study were to describe the FHTO process and to evaluate the effect of the process on HRQoL, surgical outcome and cancellation rate. The role of the APEC in the FHTO process was investigated and explored.

5. REVIEW OF THE LITERATURE

5.1. Process development

Eve though the average age of the population and the need for surgical interventions are both increasing (Etzioni et al. 2003), the number of healthcare professionals is declining (Lindfors et al. 2006). Furthermore, the health care resources available for patient hospitalisation are becoming increasingly inadequate. Both society in general and the patients requiring the operations would prefer patients to stay at home for as long as possible before the intervention. Thus, effective new ways of organising the care of surgical patients are clearly needed.

The industrial practice of quality management has become universal in healthcare organisations during the last few decades (Laffel and Blumenthal 1989, Grol 1996, Pollit 1996). Efforts to improve quality of care have been mainly focused on achieving incremental improvement of existing processes rather than undertaking a fundamental process redesign. The redesign approach has been recommended for use when the current process is undergoing a major change due to organisational factors or to the introduction of new job skill classifications, or in situation when the current process is insufficient (Plsek 1997).

The private sector has implemented many cost-saving changes in surgical processes, without sacrificing the quality of care (Pollard et al.1997, Wilmore and Kehlet 2001). Public health care has been stimulated to question and develop current processes (Hänninen 2001). For example, fast-track surgery has been developed to enhance recovery by combining unimodal evidence-based principles of care with multi-modal efforts (Kehlet 2006). This kind of approach has been reported not only to decrease the postoperative length of stay but also to reduce complication rate (Gralla et al. 2007). Today, cost-saving practices are explored in many specialities, not only in surgery (Serra-Prat et al. 2001).

5.2. Same day admission

Patient admission and discharge vary in different elective surgical processes. In the same day admission, the patient is admitted and operated on the same working day, but might be admitted for an unknown period of time into the surgical facility to receive postoperative care. There are other terms in use e.g. day surgery, which means that the patient is admitted, operated on and discharged from the surgical facility on the same working day (IAAS 2003), and short stay surgery, which indicates that the patient may require a hospital stay longer than 23 but less than 72 hours postoperatively (IAAS 2003). Both of these are same day admission processes. In traditional (i.e. inpatient) surgery, a patient is admitted to the hospital one or even several days before surgery to undergo a preoperative evaluation and preparation, and then stays in the hospital for at least one postoperative night.

Hospital admission has been associated with an increased risk of nosocomial infections, increased immobility, increased dependency and social isolation (Creditor 1993, Jarvis 1996, Weinstein 1998). In particular, individuals over 65 years old experience a significant functional decline, which results in loss of independence, decreased quality of life and increased readmission rate (Sager et al. 1996, Conforti et al. 2004, Graf 2006). Elderly patients experience also more nosocomial infections per each day of hospital admission (Saviteer et al. 1988). An association has been reported between preoperative hospital stay and nosocomial infections among surgical patients (Cruse 1981, Bueno Cavallinas et al. 1991, Sáez-Castillo et al. 2010). The most common nosocomial infection is a surgical site infection (SSI) (Watanabe et al. 2008), and this can result in a prolonged hospital stay, as well as in high morbidity, disability and mortality rates (Mangram et al. 1999, Parsons 2009). Whitehouse and co-authors (2002) stated that orthopaedic SSI prolongs the total hospital stay by a median of two weeks, doubles the rehospitalisation rates and increases health care costs by more than 30%. Thus preventing nosocomial infections is cost-effective (Weinstein 1998). An inpatient preoperative stay and an inpatient delay in undergoing elective surgery increase the risk of infectious complications (Vogel et al. 2010, deFreitas et al. 2012).

Same day admission has resulted in an improvement in case flow and furthermore reduced costs and enhanced hospital productivity (Fischer 1996, van Klei et al. 2002, Juan et al. 2006, Salazar et al. 2009). Already in 1988, a mean of 39% reduction in hospital charges was achieved by adopting same day admission and early postoperative discharge in mastectomy patients (Edwards et al. 1988). In 1989, hospital costs and charges were reported to be significantly lower due to the reduced length of stay and use of ancillary services in same day

admission compared to traditional surgery (Keithley et al. 1989). Boothe and Finegan (1995) described a 12.2% increase in total case flow after changing the admission process from the traditional to same day admission. They stated that even if the potential reduction in length of stay is less than one day, significant cost savings could still be achieved.

The benefits of same day admission have been studied in different surgical specialities. It is a cost saving strategy for aortoiliac surgery (Calligaro et al. 1997), and safe and effective for otorhinolarynology (ORL), head and neck and vascular surgery (Collier 1992, Calligaro et al. 1995, Musser et al. 1996, Kulasegarah et al. 2008). By adopting a of same day admission and an outpatient anaesthesia evaluation clinic (APEC), the preoperative length of stay decreased by 4.5 days in carotid endarterectomy and lower extremity revascularisation patients, and hospital costs were also significantly reduced (Pollard et al.1997).

It has been stated that day surgery, rather than traditional surgery, should be regarded as the norm for elective surgery (NHS Modernisation Agency 2004, Horton and Doyle 2005). The first account of day surgery was published already in 1909 (Nicoll 1909), but it took several decades before the number of day surgery units started to increase (Jarret and Staniszewski 2006). In Finland, day surgery was first introduced in the 1970s in the Helsinki and Kuopio University Hospitals (Lahtinen and Valanne 1998, Alanko et al. 1999), and since then it has gradually expanded (Alanko et al. 1990, Lahtinen and Valanne 1998). Finnish day surgery is noted as safe and of good-quality (Mattila et al. 2009). Major morbidity and mortality after day surgery are uncommon (Warner et al. 1993). Thus, day surgery is suitable for different surgical specialities (Bryson et al. 2004[1,2], Mattila et al. 2009). However, co-morbidity, type of surgery and social circumstances need to be considered before arranging day surgery (Korttila 1996, Lahtinen and Valanne 1998, American Society of Anesthesiologists Task Force on Postanesthetic Care 2002), but old age, as such, is not an obstacle (Aldwinckle and Montgomery 2004, Mattila et al. 2011). Day surgery decreases health care costs by reducing in the number of occupied hospital beds and it achieves an improvement in the overall process effectiveness (Skattum et al.2004, Smith et al. 2006, Nordin et al. 2007), in addition to decreasing the length of the hospital stay (Dexter et al. 2002, Compliment et al. 2003, Hamed and Fedorowicz 2004, Fedorowicz et al. 2011). Day surgery has also been associated with shorter sick leave during the next year after the operation (Lindqvist et al. 2005).

5.3. Anaesthesia preoperative evaluation clinic

Preoperative anaesthesia evaluation is part of the surgical procedure, and is essential for a safe anaesthetic practice (De Hert et al. 2011). Traditionally anaesthesia evaluation has been conducted with the patient as an inpatient on the day before operation. Outpatient anaesthesia evaluation clinics (APEC) were developed already in 1949 to improve patient care and optimise patients´ conditions before surgery (Lee 1949). However, they were not common until day surgery became widespread (Conway et al. 1992, Fischer 1996). In day surgery and same day admission, the objective has been to improve patient care and satisfaction, minimise operation delays and cancellations and optimise the communication between surgeon and anaesthetist (Conway et al. 1992).

APEC practices differ from each other according to the level of implementation: some clinics evaluate every surgical patient, some only subgroups of patients (Lemmens et al. 2006, Lemmens et al. 2008). Sometimes inpatient surgical patients are also evaluated at the APEC before admission to hospital (van Klei et al. 2002). The optimal way to conduct preoperative anaesthesia evaluation has been studied widely (Fischer 1996, van Klei et al. 2002, Ferschl et al. 2005, Schiff et al. 2010).

The anaesthesiologist-managed preoperative assessment reduces unnecessary laboratory testing by selecting a more careful choice of laboratory tests and the replacement of unnecessary tests by relevant ones (Roizen 1994, Starsnic et al. 1997, Vogt and Henson 1997). Fewer laboratory tests have been described to achieve to cost-savings ranging from $15.75 up to $119.09 per patient (Fischer 1996, Starsnic et al. 1997, Vogt and Henson 1997, Parker et al.2000). Operation room cancellation rates and delays have been reported to decrease after the initiation of an APEC (Conway et al. 1992, Fischer 1996, Ferschl et al. 2005). Furthermore, significant cost-savings may be achieved (Boothe and Finegan 1995, Dexter and Macario 1996).

5.4. Surgery cancellation

Cancellation of scheduled surgery results in a disruption to the surgical workload as well as wasted resources. Cancellations are expensive and inconvenient for both the hospital and the patient (Tait et al.1997, van Klei et al. 2002). The loss of operation room time has been calculated to be the most expensive of squandered hospital resources in surgical cancellations (Mangran et al. 1992). Cancellation on the day of surgery in the traditional surgical process may lead to a prolonged hospital stay and additional costs (Tait et al.1997).

The cancellation rates have varued extensively in published studies (Conway et al. 1992, Schofield et al. 2005). A multicenter study in Germany reported a cancellation rate of 12.4% in university and 5.0% in community hospitals (Schuster et al. 2011). Schofield and co-authors (2005) described a cancellation rate of 13.2% in elective, 9.5% in day only and 11.2% in other same day admission surgery. On the other hand, Conway and co-authors (1992) estimated only a 3% incidence of cancellations after implementation of an APEC. APECs have been developed as a way to maintain anaesthesia safety and prevent surgery cancellations in same day admission processes (Conway et al. 1992, Lemmens et al. 2006).

Pollard and co-authors (1996) reported that the cancellation rate decreased from 26% to 6.6% after the opening of a perioperative outpatient clinic, which consisted of both preoperative evaluation and postoperative support for outpatients. No difference was recorded in cancellation rates between patients who were assessed at the clinic 24 hour (13.3%) or 2 – 30 days (13.2%) before surgery (Pollard and Olson 1999). Ferschl and co-authors (2005) described a cancellation rate of 13.6% in a day surgery unit, and 9.0% in other same day admissions. Lower cancellation rates have been reported in patients who had been evaluated in an APEC as compared to patients that had not been subjected to this evaluation (Ferschl et al. 2005, Farasatkish et al. 2009).
ORL, cardiothoracic, trauma and plastic surgery have been reported to exhibit the highest cancellation rates of the surgery specialities (Schofield et al. 2005). Cancellation reasons vary between different studies and hospitals (Pollard and Olson 1999, Argo et al. 2009, Tung et al. 2010). In most cases, patient related issues are the most common reasons for cancellation (Sanjay et al. 2007). The top four patient related reasons have been: patient medically unfit, operation not necessary, patient unfit for surgery and patient failing to attend (Haana et al. 2009). Hospital related reasons have included lack of OR time or no postoperative bed available (Pollard and Olson 1999, Schofield et al. 2005).

5.5. From Home To Operation (FHTO) process

The from Home To Operation (FHTO) process was developed in the Hyvinkää Hospital of the Hospital District Helsinki and Uusimaa in the year 2000 to cope with the increasing patient load and limited resources. More and more patients needed operations, yet the surgical ward had a limited bed capacity and nursing staff. Furthermore, otherwise healthy patients spent the preoperative day at the ward waiting for the operation, meeting with the surgeon and anaesthesiologist, and thus depriving resources from patients more in need of care. Therefore the traditional preoperative process needed to be re-evaluated, and a new preoperative process, FHTO, was designed. The initiative to redesign the preoperative process came from the surgical administration, but the design process was executed as a cooperation between surgeons, anaesthesiologists, nurses and hospital administration. The following process depiction is printed in detail in the FHTO process description (Hyvinkää Hospital 2006).

The main focus in the FHTO process is on the patient. All preoperative evaluations and preparations are made at the same location where different health professionals come to meet the patient. The patient arrives to the hospital through the FHTO unit, walks to the operation theatre, and after the operation is either released home or admitted to a ward for postoperative treatment. Patients do not visit the surgical ward preoperatively. The process includes only necessary functions, and overlapping work between different health care professionals is minimized.
The FHTO process was introduced gradually. Initially, only one third of the elective patients were admitted on the morning of the operation. Patients with no additional health issues entering for minor operations with a need of only short postoperative care were deemed suitable for the FHTO process. In addition to the FHTO process, a separate day surgery unit from which the patients were also released back home a few hours after surgery was concurrently brought into use in the Hyvinkää Hospital. At first, the patient material consisted mostly of ORL and general surgery patients, but all different surgical specialities were represented.

A patient satisfaction questionnaire was conducted and it indicated patient satisfaction with the FHTO process, especially with the opportunity to spend the preoperative night at home (Keränen et al. 2004). The FHTO process was also found out to save over 70% of the direct labour time spent on each preoperative patient compared to the traditional process (Keränen et al. 2006). The process was further developed and new facilities for the process were

designed. Furthermore, a detailed process description was completed before inaugurating a new unit for this process (Hyvinkää Hospital 2006).

The new FHTO unit was established in the year 2006. Since then, approximately 95% of elective surgical patients have been admitted on the morning of operation through the FHTO unit. Even elderly, oncology patients and those with multiple additional health issues have been admitted through the FHTO process. The process itself has remained unchanged; the preoperative anaesthesia and surgery assessments and all preoperative preparations are performed on an outpatient basis with patients being admitted on the day of the operation. The process change in 2006 was well planned and conducted during one single day. Simultaneously, an APEC was opened to guarantee the safety of the anaesthesia procedure.

The indications for surgery are confirmed at an outpatient surgery clinic of the hospital or in primary health care. The surgeon records information concerning the patient´s additional diagnoses, the reason for the operation, possible need for special equipment for surgery, e.g. endoprosthesis and the urgency classification of the operation. The patient fills in a preliminary anaesthesiology questionnaire. These documents are then delivered to a specialised nurse in the FHTO unit. The specialised nurse examines patient records, and is in charge of maintaining and organizing the surgical waiting list and for allocating patients to APEC. The same nurse also arranges preoperative testing, e.g. laboratory and radiology exams, before the APEC consultation. At the APEC, an anaesthesiologist examines the patient, and confirms the anaesthesia type and possible medical precautions prior to the surgery. There is one exception, the patients scheduled for an arthroplasty meet also the operating surgeron at their APEC visit.

To ensure reasonable resource use, only one out of every four patients are referred to a preoperative anaesthesia consultation. The APEC visit is arranged for patients with either one severe or several less serious diseases and who are scheduled to undergo surgery with general anaesthesia or extensive regional anaesthesia. A more detailed list of the criteria for APEC consultation is provided in Table 1. Patients requiring local anaesthesia do not visit APEC, but the anaesthesiologist reviews patient records if needed. If a patient requests a supplemental preoperative appointment, this can be arranged. In those cases where some questions arise, the nurse or the operating surgeon consult the anaesthesiologist, who then may invite the patient to attend the APEC. In summary, the APEC visit indications mainly comprise of patients with one severe, or several mild diseases, or if there are psychosocial aspects that need to be taken into account.

On the day before the operation, a nurse contacts the patient to verify the admission and operation time. On the morning of the operation, the patient is admitted to the new FHTO centre, which is located adjacent to the operation rooms. The patient is responsible for adhering to the prescribed preoperative preparations, e.g. bowel emptying at home according to written instructions given at the surgical clinic earlier. A nurse interviews the patient and a final anaesthesiology evaluation and meeting with the operating surgeon is arranged within the unit. When the OR is ready, the patient walks with the operation team nurse to the OR, where intravenous lines are installed. After the surgery, patients are either transferred to a day surgery recovery room from which they are released home, or to an intensive care unit or to a surgery ward for postoperative care according to the patient´s physical status and the surgical procedure performed. The postoperative hospitalisation time is as long as needed.

Table 1. Indications for an APEC evaluation at Hyvinkää hospital

Patients scheduled for:
Laparotomy (other than gynecology), cancer laparoscopy or endoprosthetic surgery
Even mild lung or heart disease
Age over 65 years and concomitant illness requiring medication
Procedure that requires general or extensive regional anaesthesia in following conditions
Concurrent severe degree of:
heart disease
e.g. aortic or mitral stenosis, or EF <35-40%
vascular disease
lung disease
e.g. FEV1% <50
e.g. frequent visits to emergency unit or pulmonary ward
liver disease
kidney disease
e.g. P - Crea >180mmol/l
insulin dependent diabetes with complication
e.g. nephropathy or neuropathy, CAD
recurrent hypoglycemias
neurological disease
e.g. stroke, myasthenia gravis, severe MS or Parkinson disease, ALS
rheumatoid arthritis, or rheumatoid arthritis affecting the cervical spine
spinal deformities
cardiopulmonary incapacity
NYHA III or IV
CCS II-IV
obesity (BMI >40kg/m2)
severe alcohol or drug abuse
e.g. alcohol related liver cirrhosis, pancreatitis or seizures, or missed appointments
smoking (>80 pack years)
Allergy to local anaesthetics when general anaesthesia is contraindicated
e.g. Caesarean section
severe lung disease or sleep apnea
nausea caused by general anaesthesia
Severe difficulties in previous anesthesia
e.g. intubation difficulties
allergic reaction
aspiration
Age >80 years (not unconditional)
Combination of many of the above mentioned disorders, even if of milder degrees
Others:
patient refuses blood transfusions while scheduled for high risk operation
patient requests

EF = ejection fraction, FEV1% = Forced expiratory volume in 1s/ Forced vital capacity (FEV1/FVC), P – Crea = plasma creatinine level, CAD = coronary artery disease, MS = multiple sclerosis, ALS = amyotrophic lateral sclerosis, NYHA = New York Heart Association classification, CCS = Canadian Cardiac Society classification, BMI = body mass index

5.6. Cholelisthiasis and cholecystectomy

Cholesterol gallstone disease, cholelisthiasis, is a common clinical condition with a prevalence of 10-15% in adults in the western countries (Portincasa et al. 2006). It is one of the most common gastrointestinal diseases requiring hospital admission (Portincasa et al. 2006, Portincasa et al. 2012). Due to the high risk of complications (e.g. acute cholecystitis and acute biliary pancreatitis), patients presenting with the typical colicky pain, i.e. symptomatic patients, require prompt treatment. Cholecystectomy as a treatment for symptomatic cholelisthiasis was first performed already in 1882 in Germany (Langenbuch 1882, Traverso 1976, Ammon and Hofmann 1983). Cholecystectomy can be performed by laparoscopy, through a small-incision, or by open surgical operation (Berggren et al. 1994, Shamiyeh and Wayand 2005, Connor and Garden 2006, Keus et al. 2006[1,2,3]).

Laparoscopic cholecystectomy (LC) is the gold standard of treatment (Berggren et al. 1994, Portincasa et al. 2012). It is typically conducted with four trocars and carbon dioxide insufflation (Grace et al. 1991). LC is a safe procedure with a mortality rate of 0.1 - 0.7%, and it has a similar complication rate as encountered with open cholecystectomy (Keus et al. 2006[2]). The frequencies of conversion to open surgery, morbidity, mortality and length of hospital stay are similar in elderly (over 80 years old) and younger patients in LC (Kwon and Matsui 2006). The LC procedure is cost-effective (Keus et al. 2006[2]) and it decreases the postoperative hospitalisation time (Grace et al. 1991) compared to open cholecystectomy. It has been reported that LC can be performed safely (Gurusamy et al. 2008, Tenconi et al. 2008) and be cost-saving (Keulemans et al. 1998) as day surgery, without there being any increase in the postoperative complication rates. Same day admission in LC reduces costs and increases hospital productivity (Boothe and Finegan 1995).

5.7. Outcome measures of surgical treatment

The surgical outcome may be assessed in many ways. The safety of the surgical procedure can be estimated by the incidence of major morbidity, including postoperative myocardial infarction, pulmonary embolism, central nervous deficit, and respiratory failure, as well as mortality due to medical reasons (Warner et al. 1993, Coley et al. 2002, Engbaek et al. 2006). Frequently, major morbidity and mortality incidence rates are evaluated 30 days postoperatively (Warner et al. 1993). Another way of assessing the success of a surgical procedure is to evaluate HRQoL that describes an individual´s perception of the impact that health has on his or her functional ability and physical, mental and social well-being (Hays and Morales 2001). Conducting a HRQoL assessment has been recommended for institutional evaluation and benchmarking of surgical outcome (Avery et al. 2008). The 15D tool is a generic and standardised HRQoL questionnaire; it includes a single index as well as overall index measures (Sintonen 2001). The HRQoL questionnaire 15D consists of 15 dimensions: moving, seeing, hearing, breathing, sleeping, eating, speech, excretion, usual activities, mental function, discomfort and symptoms, depression, distress, vitality and sexual activity. The 15D has been utilised in surgery (Rissanen et al. 1996, Tolonen et al. 2004, Elliot et al. 2006), and it compares favourably with other similar HRQoL instruments in most of the important properties (Stavem 1999, Hawthorne et al. 2001, Sintonen 2001, Moock and Kohlmann 2008).

5.8. Economic evaluation in health care

Economic evaluations comparing two or more health care interventions considering both costs and consequences are needed if one wishes to assess which intervention is the most effective (Briggs and Gray 1999, Kernick 2003). The evaluation can be conducted in four ways (Drummond and Jefferson 1996). A cost minimisation analysis may be used if the two interventions have the same effect on health. The analysis simply reveals which method is the cheapest. Unfortunately, in only rare cases do two different methods have exactly the same effect on health. In cost-effectiveness analysis (CEA) on the other hand, the health benefits are assessed with simple measurements, such as life years gained or changes in blood pressure (Robinson 1993[1]). The problem is that the assessment of health with these kinds of measurements is rather narrow and limited. In a cost-utility analysis (CUA), health effects are measured by changes in the HRQoL (Robinson 1993[2]). Both changes in the length and in the quality of life are taken into account. These changes are combined to indicate

quality-adjusted life years (QALY) gained as a measure of effectiveness of care. In a cost-benefit analysis, the health benefits are also converted into costs, which enables a comparison of a single health care interventions costs to health benefits (Robinson 1993[3]).

Costs can be assessed at different levels (Briggs and Gray 1999) but usually a societal perspective is chosen. Then resource usage due to the different interventions is measured and valued irrespective of the party responsible for the costs (Johannesson and Meltzer 1998). Health care costs are categorised as follows: direct health care costs (e.g. direct treatment and personnel costs), direct non-health care costs (e.g. social services and different time costs such as patients´ travel time and caregivers` time), and productivity costs or indirect costs (e.g. patients` and caregivers` lost working time) (Posnett and Jan 1996). The level of which costs are included in the evaluation is decided in the study design.

QALYs are measured with health related quality of life instruments. There are two different kinds of instruments which can be used to measure QALYs (Coons et al. 2000). Generic instruments can be used over a wide range of diseases (Kopec and Willison 2003), whereas disease specific tools can be applied only for studying the diseases for which they are designed (Harris 1969, Insall et al. 1989). Specific tools are usually more sensitive in detecting changes in the HRQoL than their generic counterparts (Wiebe et al. 2003). Both tools may be used at the same time (Both et al. 2007, Krahn et al. 2007). The comparison of effectiveness of interventions by QALY data based on different instruments is limited but the difference in QALYs gained can be substantial depending on which HRQoL instrument is being used (Räsänen et al. 2006).

The CUA is recommended for economic evaluation of health care interventions (Rawlins and Culyer 2004, Rawlins 2005) and needed to ensure that health care resources are allocated to interventions that produce societal welfare.

6. AIMS OF THE STUDY

The aims of this study were to investigate the new same day admission process FHTO and the consequences of the process transition by applying different measures. The specific aims were to determine:

- the clinical and Quality of Life outcomes of the FHTO and traditional surgical process in laparoscopic cholecystectomy patients. (Study I)
- the impact of the FHTO process transition on the surgical outcome (Study II)
- the differences in the baseline characteristics and surgery outcome between patients who have and have not been evaluated at the FHTO APEC (Study III)
- the surgery cancellation rate, rate per speciality and the reasons for cancellation in the FHTO process (Study IV)

7. PATIENTS AND METHODS

7.1. Study setting

Studies I-IV were all conducted in the Hyvinkää Hospital in the Helsinki and Uusimaa Hospital District, in which the FHTO process was first developed and implemented. The hospital provides secondary health care for a rapidly growing population of 180 000. Twenty four hour emergency health care is provided in surgical, internal medicine, paediatric, gynaecology and obstrectic fields. The surgery specialities include orthopaedics and traumatology, as well as gastroenterological, plastic, endocrinological, paediatric and vein surgery. In addition, operations are performed for gynaecological and ORL disorders. The surgical treatment of cardiovascular, neurosurgery or ophthalmology patients has been centralised to the university hospital of the same hospital district.

7.2. Definitions of process types

The traditional surgical process was defined as a process where patients are admitted to a surgical ward for preoperative evaluation and preparation one day prior to the surgery. In the FHTO process patients are admitted on the day of operation through the FHTO unit adjacent to the operating rooms as same day admission. Day surgery was defined as surgery with a preoperative plan to discharge the patient on the day of surgery. The new FHTO unit was launched in September 2006, thereafter the intention has been to admit all elective surgery patients through the same unit. This intent has been achieved in over 90% of elective surgical cases.

7.3. Patients

Study I included 47 adult (over 18 years old) patients randomised to undergo LC via FHTO or traditional process in the Hyvinkää Hospital between December 2004 and July 2005. At the time, the FHTO process involved approximately 24% of all elective surgical patients, and LC was conducted mainly in the FHTO process. All the Study I participants were initially scheduled for LC in the FHTO process because of symptomatic cholelisthiasis. Further inclusion criteria were same operating surgeon, agreement to participate in the study, and Finnish-speaking. Exclusion criteria were: previously treated biliary or pancreatic infection, patient scheduled for LC as day surgery or as inpatient in the traditional surgical process, and patient scheduled for open cholecystectomy.

Study II included 1206 adult patients undergoing an elective surgical procedure in the Hyvinkää Hospital, about half between March and May in 2006 (n=592) and the remainder between March and May in 2007 (n=614). All elective surgical patients during these study periods were included in this work. Exclusion criteria were emergency, cancelled or elective day surgery. In the spring of 2006, elective surgical patients were admitted to the hospital either as inpatients in the traditional surgical process, or as FHTO patients through the small separate FHTO unit. The elective day surgery patients, who were excluded from the study, were admitted to the hospital on the morning of the operation to a separate day surgery unit. In September 2006, the new FHTO unit was inaugurated for all elective surgical patients regardless of the need for postoperative care, or the intention to discharge the patient on the day of operation. At the same time, an APEC for preoperative outpatient anaesthesia evaluation was set up. According to the predefined criteria that have been described earlier in this thesis in Table 1, only the patients with serious or many diseases patients were intended to be evaluated at the APEC.

Study III included 614 adult patients, undergoing elective surgery at the Hyvinkää Hospital between March and May in 2007, six months after the initialisation of the new FHTO unit. All elective surgical patients during the study period were included. The exclusion criteria were the same as in Study II. A proportion of the patients were selected to be evaluated at the APEC preoperatively according to the predefined criteria.
Study IV included 12 205 patients scheduled for elective surgery in the FHTO process in the Hyvinkää Hospital between July 2009 and June 2011. The study population consisted of elective day surgery patients and patients requiring postoperative care. Exclusion criteria were emergency surgery and admission to hospital as an inpatient one or more days prior to the surgery. In addition, elective Caesarean sections and procedures performed outside of an

OR (e.g. endoscopy, radiology) were excluded. During the study period, 95% of elective surgical patients were admitted on the morning of operation through the FHTO unit. Nonetheless, 5% were still admitted the day before the operation to the surgical ward. For instance these patients included patients needing blood transfusion prior to surgery.

7.4. Study designs

Study I was a randomised controlled trial, in which the randomisation was made with closed envelopes by an individual not otherwise participating in the study. Studies II and III were prospective cross-sectional cohort studies, in which patients received usual standard care. Postoperative follow up was 30 days in Studies I-III. Study IV was a retrospective data analysis, (Table 2).

In Study I patients were randomised either to be admitted through the FHTO process (n=28) or the traditional surgical process (n=19). All patients received the same standardized surgical and anaesthesia care. The preoperative admission process varied between the study groups. Patients were either admitted on the morning of operation through the small FHTO unit or on the day before the operation to the surgical ward. In the FHTO process, preoperative testing was done in primary health care and preoperative preparations were made by the patients at home. Patients met the operating surgeon and anesthesiologist on the morning of the operation in the FHTO unit, and walked by themselves to the OR. In the traditional process, preoperative testing and preparations were arranged at the surgical ward one day before the operation. Patients met the operating surgeon and anesthesiologist on the ward, and a nurse transferred the patient in a bed to the OR. The same experienced gastroenterological surgeon performed all laparoscopic cholecystectomies in both groups by the standard four-trocar technique with carbon dioxide inflation. All patients received antithrombotic medication and general anesthesia. No antibiotic prophylaxis was used. The postoperative care did not differ between study groups. Demographic and peri- and postoperative morbidity data were registered and analysed. In addition, a HRQoL was assessed by a questionnaire preoperatively in the FHTO unit or on the surgical ward and again 30 days postoperatively. The main outcomes were QALYs, the postoperative infection rate and the length of the postoperative stay.

In Study II, morbidity and mortality rates and length of hospital stay were compared between 592 patients who were operated in the study period in 2006 and 614 patients operated in 2007, six months before and after introducing the new FHTO unit. The preoperative process differed between the groups. In 2006 there were three different kinds of preoperative processes whereas in 2007 most of the patients were admitted through the same preoperative process, i.e. admission through the FHTO unit. In 2007 only a small percentage of the patients were admitted on the day before the operation. In addition, only some patients in 2007 had a preoperative anaesthesia evaluation at the APEC. Nonetheless, postoperative care was similar in both groups. The main outcomes were hospitalisation time and 30 days postoperative mortality and morbidity rates.

Table 2. Study designs.

	Study I	**Study II**	**Study III**	**Study IV**
Participants	Consecutive adult pts scheduled for elective LC	Consecutive adult elective surgical pts operated	Consecutive adult elective surgical pts operated	Consecutive scheduled operations
Study design	Prospective, randomized, controlled trial	Prospective, cross-sectional cohort study	Prospective, cross-sectional cohort study	Retrospective data analysis
Intervention	FHTO/traditional admission	No changes in standard care	No changes in standard care	-
Study groups	FHTO (n=28) Traditional (n=19)	2006 (n=592) 2007 (n=614)	APEC (n=152) Basic (n=462)	12205 scheduled operations
Outcomes	HRQoL change	LOS	Preop, periop and postop morbidity and mortality	Total cancellation rate
	LOS	Postop morbidity and mortality		Cancellations/speciality
	Postop complications			Cancellation reasons

Pts = patients, LC = laparoscopic cholecystectomy, FHTO = From Home To Operation, APEC = anaesthesia preoperative evaluation clinic, HRQoL = health-related quality of life, LOS = length of hospital stay, preop = preoperative, periop = perioperative, postop = postoperative.

In Study III, demographic data and morbidity and mortality rates, as well as the length of hospital stay were compared between 152 patients who had an APEC consultation and 462 patients who did not have an APEC consultation. Overall, 25% of patients were referred to the APEC according to the predefined indications. The length of hospital stay, preoperative demographics and morbidity, and 30 days postoperative morbidity and mortality were compared between the two groups. The admission to hospital and postoperative care was similar in both groups.

In Study IV, patients scheduled for elective surgery in the FHTO process in the Hyvinkää Hospital between July 2009 and June 2011 were included (n=12 205). The overall surgery cancellation rate, cancellation rate per specialty, and reasons for cancellations were examined retrospectively. A case was considered as cancelled if the OR schedule had been verified at 1pm on the day before but surgery had not been performed on the intended day. Surgery can be cancelled by the patient, the operating surgeon, or the anaesthesiologist. The cancellation and a categorized reason for cancellation are always recorded in real-time into the OR management software Opera (Opera 4.0 SP4, GE Healthcare). The main outcomes were total cancellation rate, rates per speciality and reasons for cancellation.

7.5. Data collection

In Studies I-III, the following demographic and clinical variables were registered for patients receiving surgical care: American Society of Anesthesiologists (ASA) status, age, sex, body mass index (BMI), surgical procedure, specialty and length of operation, perioperative complications and blood loss, preoperative process, type and length of anaesthesia, length of hospital stay, and additional diseases. These data were collected from patient records. Postoperative variables were the length of postoperative care, possible re-operation and its reason (e.g. blood loss vs. other), possible re-hospitalisation and reason, morbidity (e.g. myocardial infarction, deep venous thrombosis), postoperative infections and mortality. In Study I, also the HRQoL of the patients was assessed by the 15D HRQoL questionnaire preoperatively on the day of operation and 30 days postoperatively. In addition, the simple question ‘Is your state of health better, worse or the same as one month ago?’ was included in the study questionnaire. In Study III, information on whether the patient had visited the APEC was also registered.

In Studies I-III, data were collected from patient documents and from hospital records. Mortality was rechecked from hospital records three months postoperatively, however only mortality within 30 days was taken into account in the analyses. The hospital records are automatically updated from the national population register regarding mortality. Since patients might seek a cure for surgical site infections from primary or private health care, all surgical patients were given a letter via the treating health professional. The letter included a questionnaire concerning the type of the infection, and it was asked to be filled in and returned back to the Hyvinkää Hospital. The hospital records and the laboratory database (which is shared with primary health care) were rechecked to identify possible postoperative infections.

In Study IV, the hospital statistics of scheduled operations were studied and analysed from the OR software Opera. Data about the number of scheduled operations per speciality, number of cancelled operations per speciality, and reasons for cancellations were studied. In addition, reasons for cancellation within a speciality were collected from the database.

7.6. Ethical aspects

The Ethics Committee of Helsinki and Uusimaa Hospital District approved the Study I protocol. All patients were given written information about the study, and all patients who were included provided their written consent to participate in the study. Approval for Studies II-IV was received from the Hyvinkää Hospital area administration. In Studies II and III, patients were informed about the ongoing study but no written consent was required because data was collected from patient records and patients´ treatment did not differ from the routine. Study IV was retrospective and only routine OR management data were reviewed, hence patient consent was not required.

7.7. Statistical analyses

In Study I, statistical analyses were performed with Stata software (Stata Data Analysis and Statistical Software, Version 9.0 IC15, StataCorp LP). The small sample size was taken into account with Fisher's exact, Wilcoxon signed rank and Mann–Whitney U-tests. An Iterative Robust Regression method was employed for the baseline adjustment against potential confounders and for the conferment of clinically relevant factors associated with the QALY gain. Huber and Tukeys' biweight iterations were performed after the screening process. The QoL gained during the follow-up period was assessed as the QALYs gained due to the FHTO when compared to the traditional surgical process.

In Studies II and III, statistical analyses were performed with the SPSS statistical software (IBM SPSS Statistics, Version 14, IBM Corp). Results are given as percentages (%), mean and standard deviation (SD), median and range. Independent-Samples T-test and Pearson's chi-square test were used to test for the differences between the groups. All the tests were 2-tailed, with a critical p value of 0.05.

In Study IV, statistical analyses were performed with SPSS statistical software (IBM SPSS Statistics, Version 19, IBM Corp). Categorical data were analysed with the Pearson's chi-square test. P-values less than 0.05 were considered statistically significant. Results are presented either as means and standard deviation (SD), as median and range, or as frequencies.

8. RESULTS

8.1. Study I

A total of 47 patients were included in Study I. Of them, 28 were admitted as same day admissions in the FHTO process (FHTO group) and 19 on the day before surgery in the traditional surgical process (traditional group). The baseline characteristics were similar in both groups. The baseline and follow-up characteristics are presented in Table 3. Three urinary and one pulmonary infection occurred postoperatively in the traditional group, and two wound infections in the FHTO group.

The postoperative HRQoL profile improved slightly in the FHTO group (Figure 1), but remained largely unchanged in the traditional group, in which patients described slight deteriorations in the dimensions of moving, hearing, mental function, and vitality (Figure 2). The difference was statistically significant in vitality ($p = 0.031$). The total healthcare costs after proper adjustment for baseline QoL, age, gender, ASA group, smoking and BMI with general lineal model were 1695€ in the FHTO group and 2234€ in the traditional group. The mean difference in QALYs between the FHTO and the traditional group was 0.0174. The FHTO was deemed cost-effective at 99% probability.

Table 3. Baseline and follow up characteristics in the FHTO and the traditional group in Study I. Results are given as percentages % or as means (SE).

		FHTO (n=28)	Traditional (n=19)
Baseline			
Age, years, mean (SE)		52.4 (2.7)	55.5 (2.9)
Gender (%)	Male	28.6	26.3
	Female	71.4	73.7
BMI, mean (SE)		28.1 (0.9)	27.6 (1.3)
ASA class (%)	1	46.4	26.3
	2	39.3	47.3
	3	14.3	26.3
Smoking (%)		28.6	31.6
Queue days, mean (SE)		162.7 (15.7)	167.4 (16.7)
15D baseline score, mean (SE)*		0.9497 (0.0091)	0.9094 (0.0206)
Follow up			
15D follow up score, mean (SE)**		0.9564 (0.0112)	0.8970 (0.0299)
Postoperative infection (%)		7.1	21.1
Discharge day (%)	1st	96.4	78.9
	2nd	3.6	10.5
	3rd	0	5.3
	4th	0	5.3
Feeling (%) **, ***	Better	32.2	0
	The same	60.8	73.7
	Worse	3.6	5.3
Average QALYs gained (SE)		0.007947 (0.003479)	-0.009743 (0.004357)
Average costs, € (SE)		1686.35 (29.94)	2246.94 (154.55)

*n=19 in the traditional group and n=27 in the FHTO group **n=16 in the traditional group and n=27 in the FHTO group, *** The additional question 'Is your state of health better, worse or the same as one month ago?' in the HRQoL questionnaire

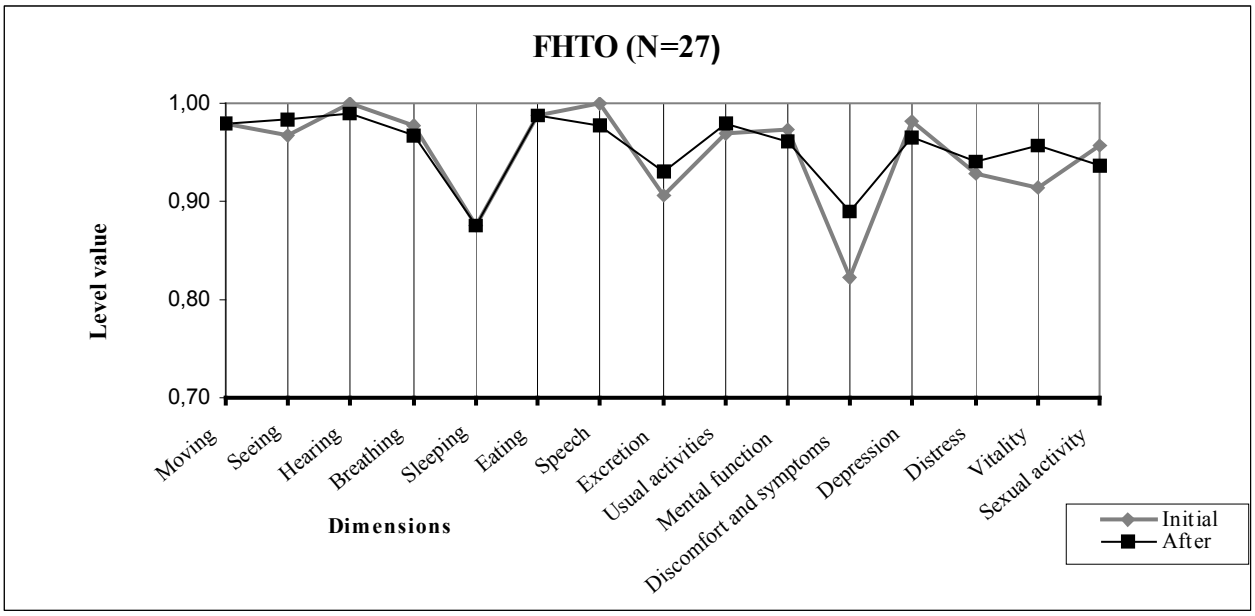

Figure 1. 15D dimensions in the FHTO group before and after the operation compared to the general population.

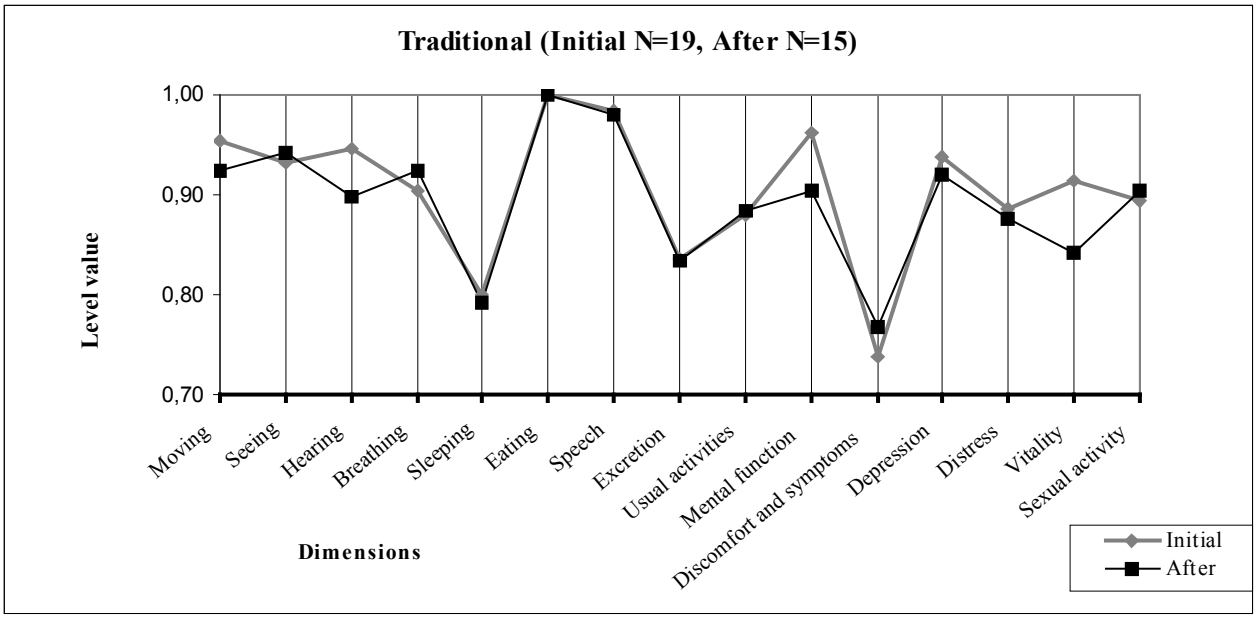

Figure 2. 15D dimensions in the traditional group before and after the operation compared to the general population.

8.2. Study II

A total of 1206 patients were included in Study II, 592 in 2006 and 614 in 2007. Baseline characteristics were similar in both years, (Table 4). No significant differences between 2006 and 2007 were found in terms of age, sex, BMI, ASA class, smoking, alcohol abuse and additional health issues. In 2006, before the new FHTO unit was established, 54% (n=317) of elective patients were admitted as same day surgery and 46% (n=270) as inpatients on the day before operation. In 2007, after the new FHTO had started, 90.5% (n=552) were admitted as same day surgery and only 9.5% (n=58) as inpatients.

The surgical specialities are presented in Figure 3. Length of operation and anaesthesia, as well as technical complication rates were similar in 2006 and 2007. However, perioperative blood loss was significantly higher in 2007 than in 2006. Postoperative complication rates and mortality were similar in both groups. The readmission and reoperation rates, number of postoperative infections, thromboembolic complications, myocardial infarctions or strokes did not differ between the groups. Two postoperative deaths were recorded in both groups ($p=0.976$). The reasons for death were cerebral infarction and metastatic cancer in 2006 and coronary artery disease with myocardial dilatation and hypertrophy, and myocardial infarction in 2007. Hospitalisation time was longer in 2006 than in 2007. The mean hospitalisation time was 3.82 days (SD 2.95) in 2006 and 3.28 (SD 2.49) in 2007 ($p<0.05$). The peri- and postoperative characteristics are presented in detail in Table 5.

Table 4. Baseline characteristics in Studies II and III (n=1206). Results are given as percentages or as means (SD). *=p<0.05

		Study II			Study III		
		2006 (n=592)	**2007** (n=614)		**APEC in 2007** (n=152)	**Basic in 2007** (n=462)	
Age, mean (SD)		56.4 (16.8)	57.6 (14.4)		66.0 (10.9)	54.7 (14.3)	
Gender (%)	Male	52.0	52.0		46.7	53.6	
	Female	48.0	48.0		53.3	46.4	
BMI, mean (SD)		27.2 (5.2)	27.4 (5.8)		28.2 (5.6)	26.9 (6.7)	*
ASA class (%)	1	25.3	25.2		1.4	32.9	*
	2	41.3	36.9		31.0	38.8	
	3	29.7	33.3		55.6	26.0	
	4	3.6	4.7		12.0	2.3	
Hypertension (%)		33.3	38.5		54.6	33.1	*
Diabetes mellitus (%)		9.8	12.9		21.7	10.0	*
Coronary artery disease (%)		10.2	10.1		14.5	8.7	*
Heart failure (%)		4.4	6.1		13.8	3.5	*
ASO (%)		1.2	0.8		0.7	0.9	
Asthma (%)		11.4	14.6		23.7	11.5	*
COPD (%)		3.1	3.3		3.9	3.1	
Rheumatoid arthritis (%)		4.8	4.1		6.6	3.3	
Psychiatric disease (%)		3.9	6.4		6.6	6.3	
Antithrombotic medication (%)		23.8	27.0		50.7	19.2	*
Kidney malfunction (%)		0.5	2.0	*	3.3	1.5	
Cancer (%)		5.4	4.9		7.4	10.7	
Immunosuppressive medication (%)		4.8	5.6		10.5	3.9	*
Hypercholesterolemia (%)		9.5	10.0		17.1	7.6	*
Liver cirrhosis (%)		1.0	0.8		2.0	0.4	
Smoking (%)		20.1	22.7		13.8	25.7	*
Alcohol abuse (%)		4.4	7.0		8.6	6.5	
Number of additional disease (%)	0	41.6	35.8		13.8	43.1	*
	1	23.6	25.2		22.4	26.1	
	2	15.3	16.0		19.1	15.0	
	3	10.7	9.8		17.8	7.2	
	4	5.6	7.9		17.1	4.8	
	5 or more	3.2	5.2		9.9	3.7	

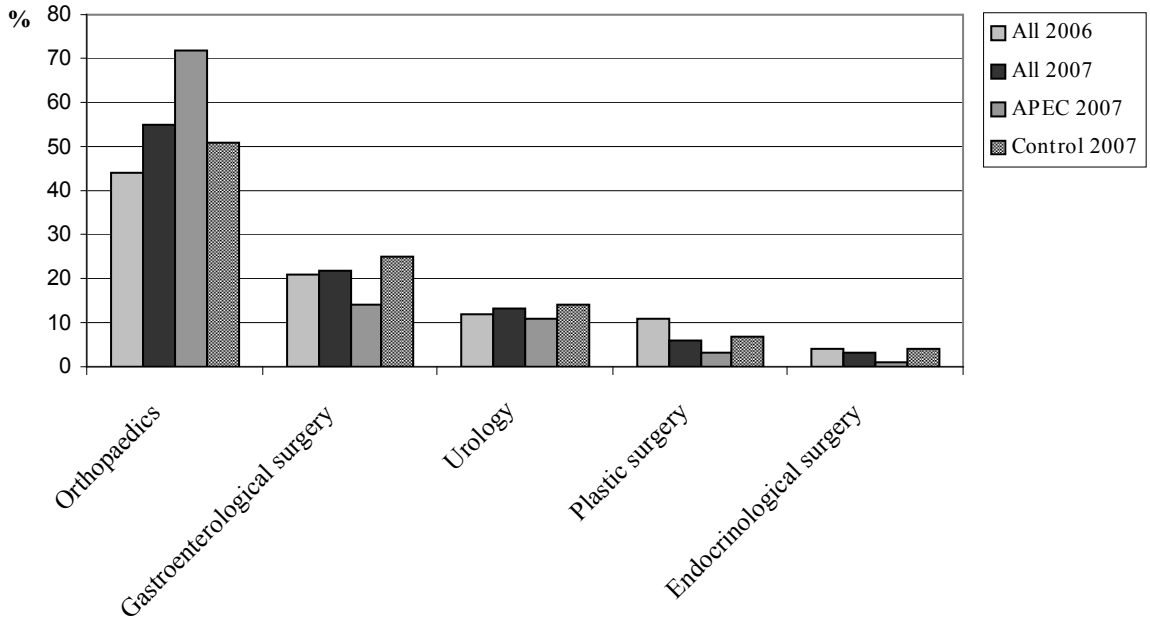

Figure 3. Surgical specialities in 2006 and 2007, and in the APEC and basic groups in 2007 (Studies II and III)

8.3. Study III

A total of 614 patients were included in Study III. Approximately one quarter (n=152) of them (APEC group) had undergone preoperative evaluation at the APEC, the remaining 75 % (n=462) (basic group) had not been evaluated. Baseline characteristics differed between the two groups in many respects (Table 4). The patients selected to APEC were older, had a higher ASA class, larger BMI and more additional health issues. Gender distribution and the incidences of chronic obstructive pulmonary disease, kidney malfunction, liver cirrhosis, arteriosclerosis obliterans (ASO), rheumatoid arthritis and psychiatric diseases were similar in both groups. On the other hand, smoking was more frequent in the basic group (25.7%) than in the APEC group (13.8%). Furthermore, 9.9 % (n=15) of APEC patients but only 3.7 % (n=17) of the basic group patients were suffering from 5 or more diseases ($p<0.01$).

Table 5. Peri – and 30 days postoperative characteristics in Studies II and III (n=1206). Results are given as percentages or as means (SD). *=p<0.05

		Study II		Study III		
		2006 (n=592)	**2007** (n=614)	**APEC in 2007** (n=152)	**Control in 2007** (n=462)	
Length of operation (min), mean (SD)		78.6 (54.1)	80.7 (54.2)	95.0 (47.4)	76.0 (55.5)	*
Technical complication (%)		2.4	2.0	3.3	1.5	
Blood loss, mean (SD)		128.7 (11.1)	187.0 (14.7)	297.1 (372.4)	82.63 (208.8)	*
Rehospitalisation (%)		4.9	6.8	9.2	5.9	
Reoperation (%)	Blood loss	0.5	0.8	0	1.1	
	Other cause	1.0	1.8	1.3	2	
Postoperative infection (%)		6.9	7.3	9.2	6.7	
Acute myocardial infarction (%)		0	0.2	0.7	0	
Pulmonary embolism (%)		0	0.2	0.7	0	
Deep venous thrombosis (%)		0	0.2	0.7	0.2	
Cerebral infarction (%)		0.5	0	0	0	
Death (%)		0.3	0.3	1.3	0	*

The perioperative characteristics were also different in patients selected to the APEC when compared to the patients with basic preoperative evaluation. Anaesthesia and the operation lasted longer, and patients suffered more severe blood loss during the operation in the APEC group. However, the rate of technical complications did not differ significantly. The most common type of anaesthesia in the basic group was general anaesthesia, and in the APEC group spinal or epidural anaesthesia with or without additional local anaesthesia. The surgical specialities are presented in Figure 3. Postoperative morbidity was similar in both groups (Table 5). Two patients died within 30 days of follow up, both patients were in the APEC group, and the difference between the groups was statistically significant (p=0.014). The causes of death were one case of coronary artery disease with myocardial dilatation and hypertrophy, and one of myocardial infarction.

8.4. Study IV

In Study IV a total of 12 205 patients were scheduled for surgery. Of them, 551 (4.5 %) cases were cancelled. The most common surgical specialities were orthopaedics 31.8%, gastroenterology 15.2 %, ORL 13.6 % and gynaecology 11.1 % (Figure 4). The cancellation rate was highest in hand surgery (8.2 %) and orthopaedic surgery (5.4 %) (Figure 5). On the other hand, endocrinological surgery had no cancellations out of the 122 scheduled operations. If one compares the two most common types of surgery, then orthopaedic surgery had more cancellations 5.4 % than gastroenterological surgery 3.8 % (p=0.006).

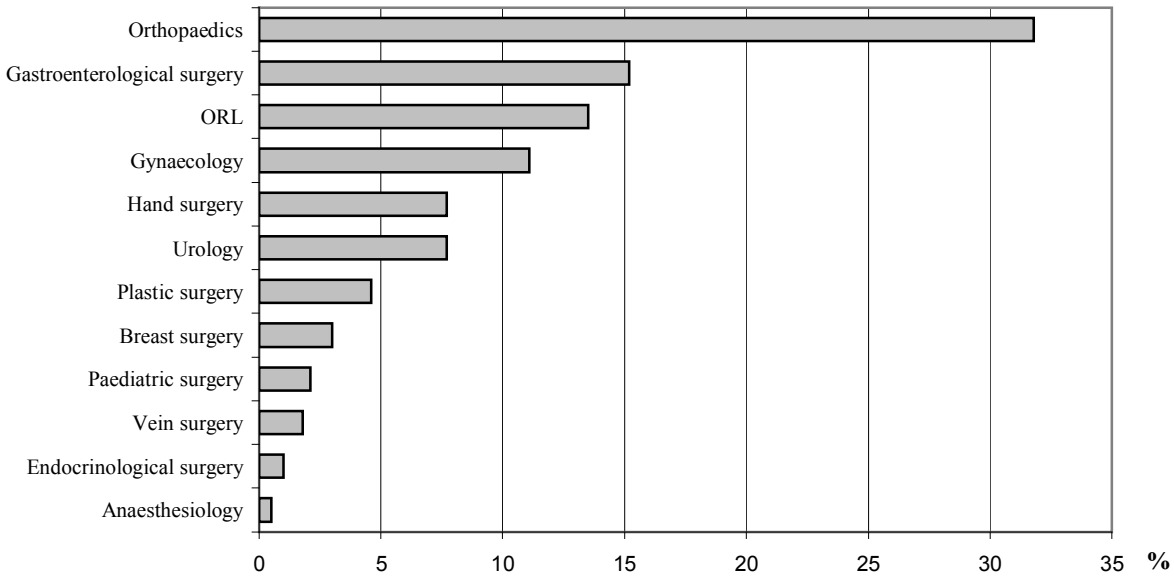

Figure 4. The distribution of all scheduled operations between surgical specialities

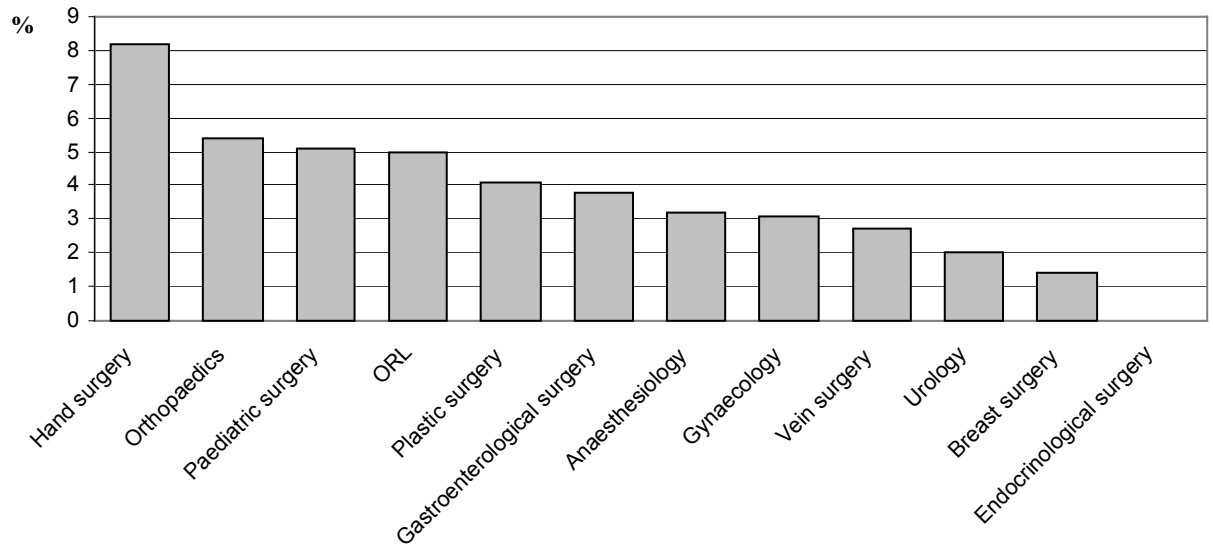

Figure 5. Cancellation rates in surgical specialities

The majority 72.4 %, of all cancellations were cancelled due to patient related reasons (Table 6). The three most common reasons were operation no longer being necessary (26 %, n=143), patient being unfit for operation (15.6 %, n=86) and acute infection (14.3 %, n=79). Those three reasons accounted for the majority, 55.9 %, of all cancelled cases.

The proportions of cancellation reasons differed between the surgery specialities. In most specialities, the largest proportion of cancellations occurred because of patient-related issues. In paediatric surgery and anaesthesiology 100 %, orthopaedic, gynaecological and ORL surgery 76 %, hand surgery 74 %, plastic surgery 78 %, vein surgery 67 %, breast surgery 60 % and gastroenterological surgery 53% of cancellations were due to patient related reasons. In urology, in contrast, only 47 % of cancellations occurred due to patient related reasons. In vein (33 %) and ORL (13%) surgery, the second largest proportion of cancellations occurred because of staff related reasons whereas in all other specialities it was hospital related reasons.

Table 6. Detailed cancellation reasons, n=551(frequencies, percentages).

Category	Specific reason	n	%
Patient related issues	Unfit for operation	86	15.6
	Unfit for anaesthesia	42	7.6
	Acute infection	79	14.3
	Failed to come to the hospital	13	2.4
	Refused surgery	6	1.1
	Operation no longer necessary	143	26
	In treatment for other cause	5	0.9
	Deceased	1	0.2
	Procedure done in private health care	1	0.2
	Other patient related reason	23	4.2
Staff related	No anesthetist	1	0.2
	No operating surgeon	34	6.2
	No nurse	8	1.5
Hospital related issues	No available OR	1	0.1
	Inefficient equipment	2	0.4
	Equipment lacking	3	0.5
	Previous operation prolonged	38	6.9
	Emergency operation prioritised	51	9.2
	Patient transported to other hospital for operation	1	0.2
	Inefficient preoperative preparations	1	0.2
	Procedure done as emergency operation	1	0.2
	OR overbooked	3	0.5
	no ICU bed available	2	0.4
	Other hospital related reason	6	1.1

9. DISCUSSION

9.1. General considerations

Solutions to control the increasing health care costs have been explored not only in the private sector but also at the governmental level (Macario et al. 1995, Karvonen et al. 2005). The private sector has been successful in decreasing the costs of surgery by implementing same day and by adopting short stay approaches (Boothe and Finegan 1995, Wilmore and Kehlet 2001, Kehlet 2006). Gradually they have been implemented into the public health care as well. In the Hyvinkää Hospital, a fundamental process redesign was executed in the preoperative process, and the new FHTO process was introduced. New facilities for the process were constructed in 2006, and simultaneously the process was broadened to involve all elective surgery.

Shortening the preoperative stay saves more costs than shortening of the hospital stay from the end of the admission (van Klei et al. 2002, Juan et al. 2006, Salazar et al. 2009). It is known that day surgery is safe and cost-effective for many specialities (Bryson et al. 2004[1,2], Fedorowicz et al. 2005, Mattila et al. 2009), yet it can be used only if the patient may be discharged on the day of the operation (American Society of Anesthesiologists Task Force on Postanesthetic Care 2002). Same day admission has also been described as being safe in many specialities (Calligaro et al. 1995, Marla and Stallard 2009), however it is claimed that the approach could be used even more widely (Calligaro et al. 1997, Rao et al. 2011). Preoperative anaesthesia evaluation is an essential part of the same day admission processes (Halaszynski et al. 2004). Outpatient APE clinics have been used either in the evaluation of all or at least a part of the elective surgical patients (Lemmens et al. 2006, Lemmens et al. 2008). The preoperative evaluation and admission to surgery is preferably centralised to one location (Halaszynski et al. 2004), however, the facilities for such activities differ dramatically between institutions (Pollard et al. 1996, Lew et al. 2004).

The FHTO unit was designed to be located adjacent to the operation rooms, so that the personnel´s time is not wasted in transferring patients. The centralised unit includes all preoperative anaesthesia evaluations, the preparation for the surgery and admission to the hospital. Thus the surgical ward is able to concentrate on postoperative patients. The FHTO process and unit are the same for all elective patients, regardless of the type of surgery, or the

possible need for postoperative care. Thus patients maintain their autonomy until they enter the OR.

This study investigated the FHTO process itself, and the effect of the comprehensive process transition to the surgical outcome by using a wide battery of different measures. First, quality of life of patients undergoing laparoscopic cholecystectomy by the FHTO process was compared to that observed in patients treated by the traditional surgical process. Second, the effect of the implementation of the new process and unit was explored by comparing surgical outcome before and after the implementation. Third, the function of an APEC in the process was analysed. Finally, the cancellation rate and reasons were inspected in the FHTO process. These studies were mainly conducted prospectively during the process development.

Health-related quality of life improved in many dimensions of the HRQoL instrument in patients undergoing the FHTO process, whereas in patients in the traditional process it remained largely at the same level as preoperatively. The improvement in the FHTO group was higher than that achieved in a previous study of same day admission in laparoscopic cholecystectomy patients (Johansson et al. 2006). The implementation of the new FHTO unit and process did not have any impact on the surgical outcome. The patients evaluated at the APEC had more serious conditions, longer operation time and suffered more frequently from technical complications and more extensive perioperative blood loss compared to the patients that were not evaluated in the APEC. In contrast, the postoperative complication rate was not higher in the APEC group. These findings are similar to those of other published studies examining the benefits of preoperative anaesthesia clinics (Fischer 1996, Ferschl et al. 2005). The cancellation rate was 4.5% in the FHTO process, which is similar to previously published studies of same day admission (van Klei et al. 2002, Tung et al. 2010), with hand and orthopaedic operations displaying the highest cancellation rates. The cancellation rate distribution between surgical specialities vary in different institutions (Schofield et al. 2005, Schuster et al. 2011). Patient-related issues dominated as the reason for cancellation. This has been the main reason identified in other studies as well (Ahmed et al. 2009).

9.2. Health-related quality of life in the FHTO process

The FHTO process was cost-effective in LC patients compared to the traditional preoperative process. The 30-day postoperative quality of life improved in the FHTO process in LC patients. When patients spend the preoperative night in a familiar environment at home, this preserves their autonomy and helps them to stay physically active. In contrast, patients treated preoperatively in a surgical ward tend to adopt the passive patient role (Graf 2006, de Saint-Hubert et al. 2009), as they are assisted in routine chores that they would normally carry out without any help at home, e.g. meals are ready and even served directly to their bed. It has been claimed that excessive preoperative rest might also affect postoperative recovery, and even predispose to postoperative infections (Vogel et al. 2010, deFreitas et al. 2012). No previous study on HRQoL of same day admission patients compared to those undergoing a traditional surgical process has been published.

The 15D questionnaire was chosen to evaluate HRQoL because it has been utilised successfully in surgery before (Elliot et al. 2006). It has also been developed in Finland (Sintonen 2001). The baseline characteristics were statistically similar in both groups, although the ASA class and the baseline 15D score were slightly better in the FHTO group. The groups were randomised, and the relatively small group size was taken into account in the statistical analyses. The preoperative 15D questionnaire was filled preoperatively either in the FHTO unit or in the surgical ward, which may have affected the preoperative HRQoL scores. Patients in the FHTO group fared postoperatively better on many dimensions of the HRQoL instrument than those in the traditional group. The dimensions that improved postoperatively in the FHTO group included seeing, excretion, usual activities, discomfort, distress and vitality. In the traditional group, the dimensions describing moving, hearing, mental function, depression, distress and vitality deteriorated postoperatively. Thus, it appears that the traditional preoperative stay at the ward may incapacitate patients and diminish their vitality, and that the preoperative preservation of a patient´s autonomy appears to be important in aiding the postoperative recovery. However, this is highly speculative because the increase of the HRQoL level in the FHTO group was moderate. Further studies with a larger number of patients will be needed to verify this conclusion.

The same day admission reduces the total length of the hospital stay by one day (Boothe and Finegan 1995). The first days of a hospital stay are usually more expensive than the days spent at the end of a hospital stay (Taheri et al. 2000). Shortening the length of the hospital stay at either end is worth the effort for both the patient and the hospital. In this study, the patients in the traditional group had a longer postoperative length of hospital stay than those

in the FHTO group. For example, all patients in the FHTO group were discharged on the first or the second postoperative day. On the other hand, there were patients in hospital still on the fourth postoperative day in the traditional group. Every day spent in a hospital increases the risk for infections (Saviteer et al. 1988, Sáez-Castillo et al. 2010). The postoperative infection rate was somewhat higher in the traditional group, but the difference did not reach a statistically significant level when compared to the FHTO group. Three urinary and one pulmonary infections were recorded in the traditional group, whereas in the FHTO group there were two wound infections. The urinary infections in the traditional group were recorded already in the first postoperative days in the hospital, which could have led to prolonged hospital stay. This may reflect the passive state of the patients at the ward since immobility is associated with problems in normal physiological functions, e.g. protracted bowel movements.

LC is a standardised, well studied gold standard treatment for symptomatic cholelithiasis (Berggren et al. 1994, Portincasa et al. 2012). Postoperative complications are rare, but if they occur they usually appear rather soon after the surgery (Keus et al. 2006[2]). The same experienced abdominal surgeon operated all the patients, which eliminates any possible differences in surgical performance between the FHTO and the traditional groups. At the time of the study, LC was routinely performed as same day admission surgery, now as day surgery. Johansson and co-authors (2006) found no significant differences in QoL between day-case and overnight-stay LC. Our HRQoL results were different. We used the 15D questionnaire, took the baseline QoL into account, and utilised a 30-day postoperative follow-up, whereas these other workers ignored the baseline QoL and assessed QoL with Psychological General Well-Being tool as well as having only a one week follow up.

Both the surgical procedure and the baseline characteristics of the patients in the FHTO and the traditional group were similar, but the preoperative HRQoL was better in the FHTO group. In this study, the only difference between the two groups was the preoperative process. Notwithstanding, the length of hospital stay was shorter and the postoperative HRQoL profile was better in the FHTO process. Furthermore, the FHTO process was cost-effective.

9.3. The effect of the FHTO process transition on the surgical outcome

The new FHTO process and unit were carefully planned beforehand, and consequently successfully inaugurated. The process shortened the mean hospitalisation time without compromising the surgical outcome.

Process changes always face multiple challenges already during the design phase (Hanan 1993, Kotter 1995). Executing a large scale process implementation in health care requires efficient and dedicated management as well as detailed predefined planning (Plesk 1997). The initial demand for process development in preoperative care in the Hyvinkää Hospital emerged from the increasing patient load and the limited ward space. These similar demands are today commonplace in all surgical facilities all around the world (Ortiga et al. 2010). The process change in the Hyvinkää Hospital was carefully planned a few years before it was implemented. Nevertheless, the possible impact of the change on surgery outcome was not clear. Thus, a prospective follow up study was designed to measure the surgery outcome six months before (2006) and after (2007) the implementation investigating all elective surgery cases. As planned the study population is diverse and large.

The baseline characteristics of the patients were similar before and after the process transition. The number of same day admissions increased greatly after the transition in 2007. Age, gender and BMI were remarkably similar in both years. Patients with four or more additional diseases, and ASA classes three and four were somewhat more frequent in 2007. Furthermore, the number of patients with many additional diseases increased in 2007, but only those with kidney malfunctions increased in a statistically significantly manner. The increase in patients with alcohol abuse is clinically significant and similar findings have been documented in Finnish statistics (Stakes 2008). The increasing trend towards the additional diseases could be due to a new process and the more accurate documentation of diagnoses. The proportion of orthopaedic operations was slightly greater, whereas the proportions of endocrinological and plastic surgery operations were slightly smaller in 2007 than in 2006. The fact that the type of operations performed usually displays a slight seasonal variation, was controlled by choosing the same three months of the year for comparison of the study periods.

Like the preoperative characteristics, also both the peri- and postoperative characteristics were rather similar before and after the FHTO process transition. The mean length of operation, as well as the number of technical complications were surprisingly similar in both years. Conversely, perioperative blood loss was significantly heavier in 2007 than in 2006.

This could be associated with slightly increased numbers of patients with alcohol abuse and antithrombotic medication in 2007. In the FHTO process, prophylactic antithrombotic medication for surgery is only given 6 hours after the operation. Hence, prophylactic medication could not have affected the increased perioperative blood loss observed in 2007. In 2006, the prophylactic medication was given preoperatively. Alcohol abuse, on the other hand, has been associated with perioperative bleeding (Oppedal et al. 2012). The reoperation and postoperative complication rates did not differ between the groups. The infection rate was similar in both study periods, although some earlier studies, including our own findings (Study I), have indicated that same day admission patients might have suffered fewer infections (Bueno Cavallinas et al. 1991, deFreitas et al. 2012).

The FHTO process transition was carefully planned and conducted simultaneously in all elective surgical specialities. The change was successful, and no significant differences in surgical outcome were reported. Postoperative morbidity and mortality rates before and after implementation of the FHTO process were comparable. The population was diverse, reflecting the reality in the hospital.

9.4. Preoperative anaesthesia evaluation in the FHTO process

The patient allocation to the APEC for preoperative anaesthesia evaluation can be considered as successful, when only the high risk patients are referred to the evaluation. These patients usually suffer from additional health issues, are planned to undergo more difficult anaesthesia and surgical procedure, or are predicted to encounter postoperative problems. Thus all patients do not need a preoperative anaesthesia evaluation.

In many studies, an outpatient preoperative anaesthesia evaluation has been shown to be cost-effective as part of the same day admission process (Fischer 1996, van Klei et al. 2002, Ferschl et al. 2005, Schiff et al. 2010). However, in published studies, the APECs have differed dramatically from each other. Pollard and co-authors (1996) described an APEC, to which patients were referred for assessment directly from the surgical clinic after they had been scheduled for surgery within the next 30 days. A health questionnaire, evaluation by a nurse and an anaesthesiologist, and appropriate laboratory testing were then conducted within the same day. After that, the patients went home, and were contacted on the day before the operation. On the next morning, the patients arrived to the clinic, which was an old surgical ward without any major remodelling. From the clinic they were transferred to the OR. This clinic was being used only for outpatients (Pollard et al. 1996). In comparison, Fischer (1996) described the development and implementation of an APEC, where all consultations,

laboratory testing and admission to hospital were organized. The surgeons could decide for themselves whether or not to refer the patient to the clinic. In the FHTO APEC, the criteria for referral are defined based on the patient´s health status rather than on a surgeon´s personal assessment. In most of the studies, preoperative testing and the basic idea of an APEC is similar to that applied here in FHTO APEC (Fischer 1996, Pollard et al. 1996, Lew et al. 2004), although in all of the published studies the facilities have been located far from the OR, or there has been an additional holding area adjacent to the OR. Here in the FHTO APEC, the key was to unite facilities for the whole process including the preoperative evaluation, which is usually made by appointment two to four weeks before surgery. Admission to hospital, and further to the OR, occur in the same facility. Patients walk themselves to the OR with an OR nurse; no ward or FHTO nurse spends any working time in transferring patients.

Patients selected for evaluation at the APEC suffered from more additional health issues and had a higher mean BMI than patients not evaluated at the APEC. The mean age of the APEC group patients was somewhat higher, but the difference was not statistically significant. Neither was the gender distribution. Almost all additional diseases were more prevalent in the APEC group, but the percentage of patients with COPD, ASO, cancer or psychiatric diseases was exactly the same in both groups. None of these patient groups are predefined indications for an APEC consultation. Surprisingly, smoking was significantly less common among APEC patients.

The ASA class and the number of additional diseases were higher among the APEC patients. However, also among the other patients, 28% had an ASA class of three or four, and 9% had four or more additional diseases. In contrast, 32% of the APEC group patients had an ASA class one or two, and 36% had at the most one additional disease. In the FHTO process, the criteria for APEC consultation considers also the type of operation and anaesthesia as recommended in the guideline for preoperative evaluation of patients undergoing non-cardiac surgery (De Hert et al. 2011). For instance, otherwise healthy patients undergoing endoprosthesis or bowel resection surgery are referred to the APEC, while patients with multiple comorbidities undergoing only minor surgery with mild local anaesthesia are not sent for consultation. Surgery specialities and the type of anaesthesia were different in the APEC group as would be expected. The ASA classification is restricted to assessing the need for preoperative evaluation (Daabis 2011).

As expected, the APEC group had also a longer mean operation time and more extensive perioperative blood loss. The technical complication rate was somewhat higher among the APEC patients, but this did not reach a statistically significant level. The overall greater

blood loss recorded after the implementation of the FHTO process was mostly associated with patients in the APEC group. These patients suffer from more additional health issues, and require more antithrombotic medication. Even though they underwent a more difficult type of operation with a longer operation time and greater blood loss, the reoperation rate did not differ between the groups although the rehospitalisation rate was slightly higher in the APEC group. The number of postoperative complications did not differ in a statistically significant manner between the groups, but infections were slightly more prevalent in the APEC group. Two deaths occurred during the study period in 2007, both of the deceased patients had been evaluated at the APEC. These findings support the associations between additional diseases or difficult operation types with prolonged operation times (Gadinsky et al. 2012) and higher complication rates (Imai et al. 2008, Kassin et al. 2012).

Lee and co-authors (1997) studied the risk of unanticipated intraoperative events in patients assessed at a preanaesthetic clinic. They noted that patients evaluated at the clinic were 1.94 times more likely to experience an unanticipated intraoperative event, and the risk also correlated with higher ASA status as well. Consequently, 75% of ASA four patients were admitted as inpatients, whereas in the FHTO process ASA status is not a decisive factor in same day admission.

Patients evaluated at the FHTO APEC suffered from more additional health issues, had more difficult operations with more extensive intraoperative blood loss and somewhat increased incidence of technical complications. Nonetheless, the postoperative complication rate did not differ as compared to patients not evaluated at the APEC. It seems that high risk patients can be admitted on the morning of the operation after a preoperative APEC evaluation without there being any increased risk of postoperative complications. Some studies suggest that all patients should be evaluated at an APEC prior to surgery (Lemmens et al. 2006, Schiff et al. 2010). The findings of this study, on the contrary, do not support the idea that every patient needs to be evaluated at the APEC.

9.5. Surgery cancellation rates in the FHTO process

The percentage of cancelled operations on the planned operation day was 4.5% in the FHTO process. Similar rates have been reported in other studies as well (Schuster et al. 2011). The majority of the cancellations were due to patient-related issues.

Cancellation at the last minute before the operation imposes an additional burden on both the patient and the hospital. The patient has prepared his or her personal life and employment assuming that the operation is going to happen, and if cancellation occurs due to hospital or staff related issues, it may affect many people in addition to the patient. In the same way, cancellation due to patient related issues can lead to personnel frustration and lost OR time (Tait et al. 1997). Cancellation of an operation is fundamentally an unwanted situation for all involved. It increases hospital costs since there is unused equipment, loss of OR time and personnel expertise wasted (Tessler et al. 1999, Dexter et al. 2002).

The cancellation rate in same day admission has been reported to be as high as 26% before implementing an APEC (Pollard et al. 1996). In other studies, the rate has varied between 3% and 13% with an APEC and same day admission (Conway et al. 1992, Pollard and Olson 1999, Schofield et al. 2005). Ferschl and co-authors (2005) assessed a cancellation rate of 6.6% in patients evaluated in the APEC prior to surgery and 15.0% in patients not evaluated in the clinic. The total cancellation rate of 4.5% in the FHTO process agrees well with those found in previous studies, but the proportion of same day admission in these studies has been usually smaller (Ferschl et al. 2005, Schofield et al. 2005). Fischer (1996) described a very low cancellation rate of 0.2%. However, he did not include cancellations because of patient originated rescheduling or inconvenience, or changes in the surgery indications. Furthermore, he included only cancellations made on the morning of operation, not those arranged on the preoperative evening. A cancellation in the current study was defined as a cancellation after the operation room schedule had been verified after 1pm on the previous day irrespective of the reason for cancellation.

The surgical specialities had different cancellation rates. Hand, orthopaedic, paediatric and ORL surgery displayed the highest cancellation rates, while endocrinology had no cancellations at all. Breast, urological and vein surgery had a moderate rate of 1-3%. Schofield and co-authors (2005) reported the highest cancellation rates in ORL, cardiothoracic, trauma and plastic surgery, with the lowest rates in gynaecological oncology surgery. A German multicenter study, reported the highest rate in general surgery and the lowest in gynaecological surgery (Schuster et al. 2011). The specialities present in the

hospital, of course, influence the number of cancellations. For instance, cardiothoracic surgery is not performed in the Hyvinkää Hospital at all, and emergency surgeries were not included in the analysis. The difference between endocrinological surgery on the one hand, and orthopaedic surgery on the other, can probably be explained by the indications for surgery. Endocrinological operations were mainly thyroid operations, which have explicit surgical indications, whereas the indications for hand and orthopaedic operations may be less clear cut.

The reasons for cancellation are interesting. Patient-related issues accounted for the majority of cancellations among most of the specialities, but in urology, hospital related reasons were most prevalent. Overall, patient-related issues were responsible for over 70% of all cancellations. The reasons for cancellations vary in the published studies. Patient no-show has been described in some studies (Argo et al. 2009, Haana et al. 2009) but this may reflect the patient profile of the hospital. In the USA, financial difficulties may lead to a patient no-show (Basson et al. 2006, Argo et al. 2009), which was not the case in our material. In our study the most common of all the different reasons was that the operation was deemed no longer to be necessary.

The traditionally long waiting time for surgery in Finland may well have affected surgery cancellation rates. Even though, the waiting time is decreed by law to be less than six months, this target is not fully achieved (National Institute for Health and Welfare 2012). Many orthopaedic and hand surgery disorders may even improve with time, rendering the operation unnecessary and thus leading to higher cancellation rates in those kinds of patients. In the FHTO process, endoprosthesis patients are referred to the APEC, and they also meet the operating surgeon there. Other orthopaedic patients may not meet a surgeon or an anaesthetist between the decision concerning the need for surgical treatment and the operation morning. Currently, it is not feasible to organize extra ambulatory appointments for all patients within a few weeks before surgery. The indications for surgery need to be investigated and confirmed carefully before booking the surgery and scheduling the use of the OR. Rather than having a risk for late cancellation, consulting a physiatrist about conservative treatment could represent a better option.

About one quarter of elective patients are referred for a preoperative anaesthesia evaluation to the APEC in the FHTO process. A trained nurse screens all surgical patients at the time that the operation decision is made, and then refers the patients to the APEC according to predefined criteria. APEC processes have been shown to prevent cancellations and operation delays (van Klei et al. 2002, Ferschl et al. 2005). A patient being unfit for anaesthesia was the reason for cancellation in only 7.6% of the cases in the FHTO process. The treatment of

chronic diseases should be optimised before the operation so that they will not cause cancellations. However, in our material, patients unfit for anaesthesia or surgery accounted for 23% of cancellations. Whether or not these patients had been evaluated at the APEC, and the possibility that these cancellations could have been prevented, could not be determined in this study, therefore further studies are needed.

Cancellations due to over-running of the OR schedule or the room being required for emergency operations were the most common hospital related reasons. A separate OR dedicated only for traumatology and emergency operations could decrease the numbers of cancellations due to prioritised emergency operations. Furthermore, all possible attempts should be made to minimise prolongation of operations which can cause a knock-on delay in the subsequent scheduled operations. The software Opera used in Hyvinkää Hospital assesses automatically the time needed for the operation according to the mean duration of the surgeon´s previous similar surgeries. In contrast, in some other institutes, the surgeons estimate the time needed by themselves, which may lead to an underestimation and further delays in the subsequent operations (Schofield et al. 2005). A block time system preventing cancellations due to over-running of the OR schedule has been described (Trentman et al. 2010), but it is not presently being considered to be implemented in Finland.

Altogether, the cancellation rate was quite low in the FHTO same day admission process. The majority of cancellations were due to patient related-issues, in particular the situation that the operation no longer was deemed necessary, which emphasises the need for patient education and the careful establishment of indications for surgery.

9.6. Study limitations

Studies I-IV were all conducted in the same hospital. The main focus in all of them was the FHTO process, which was first designed in the study hospital. Therefore, these studies could not have been conducted elsewhere at the time. However, today the FHTO process has been implemented in many different institutions. Nonetheless, the reproduction of the study designs reported here may be problematic due to different levels and time schedules of implementation.

Study I was a prospective randomised controlled trial. No power analysis was conducted, and the sample size was small. The randomisation was made by closed envelopes by an individual not otherwise participating in the study. It was not made in small blocks, which is

why the group sizes are different. The small sample size and different group size were taken into account in the statistical analyses. The initial HRQoL questionnaire was filled in after the randomisation, and the initial HRQoL score was higher in the FHTO group.

Study II was a non-randomised prospective cross-sectional cohort study. The study periods were six months before and six months after implementation of the new integrated FHTO process and the inauguration of the new unit. The study population was large and variable, therefore outcomes of specific patient groups cannot possibly be defined. Certain types of surgery, e.g. cardiothoracic, vascular and neurosurgery, are not performed in the Hyvinkää Hospital, therefore the findings reported here would not necessarily apply to those specialities.

Study III was prospective and designed as part of Study II already at the end of 2005. All indications for the APEC consultation were not clarified before Study II, thus allergy towards anaesthetic substances was not specified as a study variable. Study III focused on the APEC, which was implemented simultaneously with the new FHTO unit. All elective surgical patients were included in this study, therefore the study population is wide and conclusions regarding specific patient groups may be difficult to draw. The limitation concerning the surgical specialities involved is similar to that in Study II. Data concerning the interventions conducted at the APEC visit was not gathered. The groups were different and therefore not comparable, which limits generalising conclusions. This study can only be described as descriptive.

Study IV was a retrospective data analysis, that examined the condition of surgery cancellations in the FHTO process. No data was available about cancellations before the inauguration of the FHTO. Therefore no firm conclusions can be drawn about the effect of the FHTO on the surgery cancellation rate. The cases were recorded and categorised reasons for cancellation were registered in real-time with the same instructions since the introduction of the cancellation recording system. The study population is large and heterogeneous representing a typical distribution of Finnish surgical patients. In order to minimise any possible short time variation in the cancellation rates, the chosen study period was long.

9.7. Future prospects

The traditional preoperative process should be consigned to history and the preoperative processes evaluated and redesigned as a whole. The anticipated result should be the end to the separation of day surgery from other surgical activities and the organisation of all preoperative functions into one centralised location close to the operation rooms. The need for preoperative hospitalisation should be questioned at all levels and same day admission should be the norm for all patients undergoing elective surgery.

A preoperative anaesthesia evaluation is essential for safe anaesthetic practises in same day admission processes. The guideline for anaesthesia evaluation in elective non-cardiac surgery outlined, that all patients can be screened by a trained nurse, and only a subgroup of patients really need to undergo an evaluation by an anaesthesiologist prior to surgery (deHert et al. 2011). The criteria for the FHTO APEC consultation are similar to those outlined in the guideline. Nevertheless, evaluating and refining the individual criteria for certain patient groups are important for future practice. Unnecessary testing and consultation consumes resources that could be used elsewhere (Gibby 2002). The proportion of patients evaluated at the APEC should always be optimised. In less clear cut cases, the interaction between different organisational actors is crucial. For example, 36.2% of the APEC group patients had a maximum of one additional health issue. This group of patients needs to be explored to identify and eliminate unnecessary visits.

The different diseases and other health related aspects (e.g. smoking and alcohol abuse) need further investigation in the FHTO process. Alcohol abuse increased in 2007, which has been noted also in the Finnish statistics (Stakes 2008). Alcohol abuse may pose new challenges in organising surgical treatment (Oppedal et al. 2012). These are issues which require further assessment. In addition, the numbers of patients with kidney malfunction increased notably in 2007. Kidney malfunction is often associated with electrolyte imbalance, changes in the pharmacokinetics of drugs and problems in other organs (Go et al. 2004). The cause of this increase remains unknown, and clearly deserves further study. Smoking was surprisingly more frequent in the healthier control group than in the APEC group. Smoking prevention has been highlighted during recent years. Our study indicates that patients with more health problems do not smoke or have been able to quit. This issue is very important and needs to be studied and analysed so that it will be possible to improve the prevention guidelines and devise programs targetting these healthier patients.

The cancellation rates in other Finnish hospitals should be used for comparison. A uniform practise to catalogue cancellation reasons could make it possible to make relevant comparisons between different surgical facilities. The cancellation rate is a good measure for the success of a surgical process. The cancellation rates and reasons why it is higher in hand and orthopaedic surgeries require future clarification. The emphasis should also be placed on the indications for surgery. One relevant question is how well are the Finnish criteria for elective surgery (Ministry of Social Affairs and Health 2010) actually utilised and followed. A study investigating the effect of patient education on surgery cancellations could well lead to improved patient instructions, and also to a reduced cancellation rate by eliminating many of the patient-related issues.

Previously patient satisfaction with the new FHTO had not been evaluated. A patient satisfaction query in 2004 described a positive altitude towards the FHTO process (Keränen et al. 2004). Since then, the process has developed and new facilities have been introduced. Therefore the results of the old enquiry may be out-of-date, and a new survey is needed.

The direct and indirect costs of the FHTO process need to be determined. Same day admission has been proved to be cost-effective in other studies (Keithley et al 1989, Pollard et al 1997), and here too the FHTO process was found cost-effective in the preliminary study in LC patients (Keränen et al. 2007, Soini et al. 2007). New facilities and processes require funding, and this needs to be taken into account in the calculations. Total direct costs, including hotel costs and possible savings in the preoperative testing need to be assessed in the FHTO process. The indirect costs, including the length of sick leave and costs of care and assistance by relatives, also need to be explored and calculated. Determining the total costs of the FHTO process is important for future process development in public health care.

10. CONCLUSIONS

The FHTO process was associated with improved postoperative health-related quality of life, particularly in the dimension of vitality. In contrast, the traditional preoperative process was not associated with an improved health-related quality of life. The FHTO seems also to reduce the postoperative hospitalisation time.

The FHTO process transition had no adverse effect on surgical outcome. Thus the transition can be safely conductes, although it is essential that there is detailed preparatory planning and a motivated personnel.

Only the high risk patients should be referred to the APEC. There is no need for every patient to be evaluated in the APEC.

The cancellation rate in the FHTO process is reasonable, but can still be reduced. Hand, orthopaedic, paediatric and ORL surgeries have the highest cancellation rates. Patient-related issues, particularly the fact that the operation is no longer deemed necessary, account for most of the cancellations.

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12. REFERENCES

Ahmed T, Khan M, Khan FA. Cancellation of surgery in patients attending the preoperative anaesthesia assessment clinic: a prospective audit. J Pak Med Assoc 2009;59:547-50.

Ammon HV, Hofmann AF. The Langenbuch paper. I. An historical perspective and comments of the translators. Gastroenterology 1983;85:1426-33.

Alanko A, Hulkko A, Ilonen C, Kekomäki M, Kiviluoto H, Korttila K, Kotilainen H, Laatikainen L, Lahtinen J, Linnakko E, Myllynen P, Niinimäki T, Vainio-Mattila J, Ylöstalo P. Lyhythoitoisen kirurgian periaatteet ja toteuttaminen eri erikoisaloilla. Lääkintöhallituksen julkaisuja 170. Helsinki: Valtion painatuskeskus 1990. (In Finnish)

Alanko A, Korttila K, Lahtinen J, Nenonen M, Permi J, Punnonen H. Päiväkirurgia laajenee – omassa yksikössään vai leikkausosaston sisällä? Duodecim 1999;115:2049-50. (In Finnish)

Aldwinckle RJ, Montgomery JE. Unplanned admission rates and postdischarge complications in patients over the age of 70 following day case surgery. Anaesthesia 2004;59:57-9.

American Society of Anesthesiologists Task Force on Postanesthetic Care. Practice guidelines for postanesthetic care: a report by the American Society of Anesthesiologists Task Force on Postanesthetic Care. Anesthesiology 2002;96:742-52.

Argo JL, Vick CC, Graham LA, Itani KMF, Bishop MJ, Hawn MT. Elective surgical case cancellation in the Veterans Health Administration system: identifying areas for improvement. Am J Surg 2009;198:600-6.

Avery KNL, Gujral S, Blanzeby JM. Patient-reported outcomes to evaluate surgery. Expert Rev Pharmacoecon Outcomes Res 2008;8:43-50.

Basson MD, Butler TW, Verma H. Predicting patient non-appearance for surgery as a scheduling strategy to optimise operating room utilization in a Veterans´ Administration Hospital. Anesthesiology 2006;104:826-34.

Berggren U, Gordh T, Grama D, Haglund U, Rastad J, Arvidsson D. Laparoscopic versus open cholecystectomy: hospitalization, sick leave, analgesia and trauma responses. Br J Surg 1994;81:1362-5.

Both H, Essink-Bot M-L, Bussbach J, Nijsten T. Critical review of generic and dermatology-specific health-related quality of life instruments. J Invest Dermatol 2007;127:2726-39.

Boothe P, Finegan BA. Changing the admission process for elective surgery: an economic analysis. Can J Anaesth 1995;42:391-4.

Briggs AH, Gray AM. Handling uncertainty when performing economic evaluation of healthcare interventions. Health Technol Assess 1999;3(2).

Bryson GL, Chung F, Finegan BA, Friedman Z, Miller DR, van Vlymen J, Cox RG, Crowe MJ, Fuller J, Henderson C, Canadian Ambulatory Anesthesia Research Education group. Patient selection in ambulatory anesthesia – an evidence-based review: part I. Can J Anaesth 2004;51:768-81. (1)

Bryson GL, Chung F, Cox RG, Crowe MJ, Fuller J, Henderson C, Finegan BA, Friedman Z, Miller DR, van Vlymen J, Canadian Ambulatory Anesthesia Research Education group. Patient selection in ambulatory anesthesia – an evidence-based review: part II. Can J Anaesth 2004;51:782-94. (2)

Bueno Cavanillas A, Rodriguez-Contreras R, Delgado Rodriguez M, Moreno Abril O, López Gigosos R, Guillen Solvas J,Gálvez Vargas R. Preoperative stay as a risk factor for nosocomial infection. Eur J Epidemiol 1991;7:670-76.

Calligaro KD, Dougherty MJ, Raviola CA, Musser DJ, DeLaurentis DA. Impact of clinical pathways on hospital costs and early outcome after major vascular surgery. J Vasc Surg 1995;22:649-60.

Calligaro KD, Dandura R, Dougherty MJ, DeLaurentis DA, Raviola CA. Same-day admissions and other cost-saving strategies for elective aortoiliac surgery. J Vasc Surg 1997;25:141-4.

Coley KC, Williams BA, DaPos SV, Chen C, Smith RB. Retrospective evaluation of unanticipated admissionsand readmissions after same day surgery and associated costs. J Clin Anesth 2002;14:349-53.

Collier PE. Carotid endarterectomy: a safe cost-efficient approach. J Vasc Surg 1993;16:926-33.

Compliment JM, Gendelman MS, Allera JF, Matisz M, Horvath J, Hores KM, Sperring K, Herbert C, Smith JM, Kurpakus BJ, Borgman KM, Post JC. Outpatient treatment suite: a safe and cost effective venue to perform myringotomy and tubes placement in children. Int J Pediatr Otoshinolaryngol 2003;67:1159-68.

Conforti DA, Basic D, Rowland JT. Emergency department admissions, older people, functional decline, and length of hospital stay. Australas J Ageing 2004;23:189-94.

Connor S, Garden OJ. Bile duct injury in the era of laparoscopic cholecystectomy. Br J Surg 2006;93:158-68.

Conway JB, Goldberg J, Chung F. Preadmission anaesthesia consultation clinic. Can J Anaesth 1992;39:1051-7.

Coons SJ, Rao S, Keininger DL, Hays RD. A comparative review of generic quality-of-life instruments. Pharmacoeconomics 2000;17:13-35.

Creditor MC. Hazards of hospitalisation of the elderly. Ann Intern Med 1993;118:219-23.

Cruse P. Wound infection surveillance. Rev Infect Dis 1981;3:734-37.

Daabis M. American Society of Anaesthesiologists physical status classification. Indian J Anaesth 2011;55:111-5.

deFreitas DJ, Kasirajan K, Ricotta JJ 2nd, Veeraswamy RK, Corriere MA. Preoperative inpatient hospitalization and risk of perioperative infection following elective vascular procedures. Ann Vasc Surg 2012;26:46-54.

De Hert S, Imberger G, Carlisle J, Diemunsch P, Fritsch G, Moppett I, Solca M, Staender S, Wappler F, Smith A. Preoperative evaluation of the adult patient undergoing non-cardiac surgery: guidelines from the European Society of Anaesthesiology. Eur J Anaesthesiol 2011;28:684-722.

de Saint-Hubert M, Schoevaerdts D, Poulain G, Cornette P, Swine C. Risk factors predicting later functional decline in older hospitalized patients. Acta Clin Belg 2009;64:187-94.

Dexter F, Macario A. Applications of information systems to operating room scheduling. Anesthesiology 1996;85:1232-4.

Dexter F, Blake JT, Penning DH, Sloan B, Chung P, Lubarsky DA. Use of linear programming to estimate impact of changes in a hospital's operating room time allocation on perioperative variable costs. Anesthesiology 2002;96:718-24.

Drummond MF, Jefferson TO. Guidelines for authors and peer reviewers of economic submissions to the BMJ. BMJ 1996;313:275-83.

Edwards MJ, Broadwater JR, Bell JL, Ames FC, Balch CM. Economic impact of reducing hospitalisation in mastectomy patients. Ann Surg 1988;208:330-6.

Elliott D, Lazarus R, Leeder SR. Proxy respondents reliably assessed the quality of life of elective cardiac surgery patients. J Clin Epidemiol 2006;59:153-9.

Engbaek J, Bartholdy J, Hjortso NC. Return hospital visits and morbidity within 60 days after day surgery: a retrospective study of 19,736 day surgical procedures. Acta Anaesthesiol Scand 2006;50:911-9.

Etzioni DA, Liu JH, Maggard MA, Ko CY. The aging population and its impact on the surgery workforce. Ann Surg 2003;238:922-7.

Farasatkish R, Aghdaii N, Azarfarin R, Yazdanian F. Can preoperative anesthesia consultation clinic help to reduce operating room cancellation rate of cardiac surgery on the day of surgery? M.E.J. Anesth 2009;20:93-96.

Fedorowicz Z, Lawrence D, Gutierrez P, van Zuuren EJ. Day care versus in-patient surgery for age-related cataract. Cochrane Database Syst Rev 2011;6:CD004242.

Ferschl MB, Tung A, Sweitzer BJ, Huo D, Glick DB. Preoperative clinic visits reduce operating room cancellations and delays. Anesthesiology 2005;103:855-9.

Fischer SP. Development and effectiveness of an anesthesia preoperative evaluation clinic in a teaching hospital. Anesthesiology 1996;85:196-200.

Gadinsky NE, Manuel JB, Lyman S, Westrich GH. Increased operating room time in patients with obesity during primary total knee arthroplasty: conflicts for scheduling. J Arthroplasty 2012;27:1171-6.

Gibby GL. How preoperative assessment programs can be justified financially to hospital administrators. Int Anesthesiol Clin 2002;40:17-30.

Go AS, Chertow Gm, Fan D, McCulloch CE, Hsu C. chronic kidney disease and the risk of death, cardiovascular events and hospitalization. N Engl J Med 2004;351:1296-305.

Grace PA, Quereshi A, Coleman J, Keane R, McEntee G, Broe P, Osborne H, Bouchier-Hayes D. Reduced postoperative hospitalisation after laparoscopic cholecystectomy. Br. J Surg 1991;78:160-2.

Graf C. Functional decline in hospitalized older adults. Am J Nurs 2006;106:58-68.

Gralla O, Haas F, Knoll N, Hadzidiakos D, Tullmann M, Romer A, Deger S, Ebeling V, Lein M, Wille A, Rehberg B, Loening SA, Roigas J. Fast-track surgery in laparoscopic radical prostatectomy: basic principles. World J Surg 2007;25:185-91.

Grol R. Quality improvement: an international commodity? Qual Health Care 1996;5:1-2.

Gurusamy K, Junnarkar S, Farouk M, Davidson BR. Meta-analysis of randomized controlled trials on the safety and effectiveness of day-case laparoscopic cholecystectomy. Br J Surg 2008;95:161-8.

Haana V, Sethuraman K, Rosen H, Meara JG. Case cancellations on the day of surgery: an investigation in an Australian paediatric hospital. ANZ J Surg 2009;79:636-40.

Halaszynzki TM, Juda R, Silverman DG. Optimizing postoperative outcomes with efficient preoperative assessment and management. Crit Care Med 2004;32:76-86.

Hamed WW, Fedorowicz Z. Day care versus in-patient surgery for age-related cataract. Cochrane Database Syst Rev 2004;(1):CD004242.

Hanan KB. Achieving performance breakthroughs in an HMO business process through quality planning. Qual Manag Health Care 1993;1:35-45.

Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: Treatment by mold arthroplasty. An end-result study using a new method of result evaluation. J Bone Joint Surg Am 1969;51:737-55.

Hawthorne G, Richardson J, Day NA. A comparison of the Assessment of Quality of Life (AqoL) with four other generic utility instruments. Ann Med 2001;33:358-70.

Hays RD, Morales LS. The RAND-36 measure of health-related quality of life. Ann Med 2001;33:350-7.

Horton B, Doyle B. Day case surgery: a modern view. Br J Hosp Med (Lond) 2005;66:631-3.

Hyvinkää Hospital. LEIKO – toiminta 2006. The Hospital District of Helsinki and Uusimaa Hyvinkää Hospital 2006.

Hänninen E. Stakes Hyvinvointia tietoteknologiahankkeilla – parhaat toimintamallit yhteiseen käyttöön, Sairaalaviesti 2001;2:9-11. (In Finnish)

Imai E, Ueda M, Kanao K, Kubota T, Hasegawa H, Omae K, Kitajima M. Surgical site infection risk factors identified by multivariate analysis for patients undergoing laparoscopic, open colon, and gastric surgery. Am J Infect Control 2008;36:727-31.

Insall JN, Dorr LD, Scott WN. Rationale of the Knee Society clinical rating system. Clin Orthop Relat Res 1989;248:13-4.

International Association for Ambulatory Surgery. Ambulatory (Day) Surgery, suggested international terminology and definitions 2003. http://www.iaas-med.com/images/stories/uploaded_files/IAAS_definitions.pdf (accessed July 2012).

Jarret PEM, Staniszewski A. The development of ambulatory surgery and future challenges. In: Lemos P, Jarret P, Philip B, eds. Day Surgery Development and Practice. Londn, UK: International Association for Ambulatory Surgery (IAAS) 2006;21-34.

Jarvis WR. Selected aspects of the socio-economic impact of nosocomial infections: morbidity, mortality, cost, and prevention. Infect Control Hosp Epidemiol 1996;17:552-7.

Johhannesson M, Meltzer D. Some reflections on cost-effectiveness analysis. Health Econ 1998;7:1-7.

Johansson M, Lundell L, Thune A, Nelvin L. Randomized clinical trial of day-care versus overnight-stay laparoscopic cholecystectomy. Br J Surg 2006;93:40-5.

Juan A, Salazar A, Alvarez A, Perez JR, Garcia L, Corbella X. Effectiveness and safety of an emergency department short-stay unit as an alternative to standard inpatient hospitalisation. Emerg Med J 2006;23:833-37.

Kassin MT, Owen RM, Perez S, Leeds I, Cox JC, Schnier K, Sadiraj V, Sweeney JF. Risk factors for 30-day hospital readmission among general surgery patients. J Am Coll Surg 2012;Jun 20. (Epub ahead of print)

Kehlet H. Future perspectives and research initiatives in fast-track surgery. Langenbecks Arch Surg 2006;391:495-8.

Keithley J, Glandon GL, Llewellyn J, Berger B, Levin D. The cost-effectiveness of same-day admission surgery. Nurs Econ 1989;7:90-3.

Kernick DP. Introduction to health economics for the medical practitioner. Postgrad Med J 2003;79:147-50.

Keränen J, Soini EJO, Ryynänen OP, Hietaniemi K, Keränen U. Economic evaluation comparing From Home To Operation same day admission and preoperative admission one day prior to the surgery process: a randomized, controlled trial of laparoscopic cholecystectomy. Cur Med Res Opin 2007;23:2775-84.

Keränen U, Tohmo H, Laine P. Leikkaukseen kotoa (LEIKO) – potilastyytyväisyys Hyvinkään sairaalassa. Suom Lääkäril 2004;48:4739-43. (In Finnish)

Keränen U, Keränen J, Wäänänen V. LEIKO (Leikkaukseen kotoa) ja perinteinen preoperatiivinen prosessi vertailussa. Suom Lääkäril 2006;61:3603-7. (In Finnish)

Keulemans Y, Eshuis J, de Haes H, de Wit LT, Gouma DJ. Laparoscopic cholecystectomy: day-care versus clinical observation. Ann Surg 1998;228:734-40.

Keus F, de Jong JA, Gooszen HG, van Laarhoven CJ. Small-incision versus open cholecystectomy for patients with symptomatic cholecystolithiasis. Cochrane Database Syst Rev 2006:CD004788. (1)

Keus F, de Jong JA, Gooszen HG, van Laarhoven CJ. Laparoscopic versus open cholecystectomy for patients with symptomatic cholecystolithiasis. Cochrane Database Syst Rev 2006:CD006231. (2)

Keus F, de Jong JA, Gooszen HG, van Laarhoven CJ. Laparoscopic versus small-incision cholecystectomy for patients with symptomatic cholecystolithiasis. Cochrane Database Syst Rev 2006:CD006229. (3).

Kopec JA, Willison KD. A comparative review of four preference-weighted measures of health-related quality of life. J Clin Epidemiol 2003;56:317-25.

Korttila K. Päivä- ja lyhythoitoisen kirurgian onnistumisen kulmakivet. Käytännön Lääkäri 1996;2:55–60. (In Finnish)

Kotter JP. Leading change: why transformation efforts fail. HBR 1995;73:59-67.

Krahn M, Bremner KE, Tomlinson G, Ritvo P, Irvine J, Naglie G. Responsiveness of disease-specific and generic utility instruments in prostate cancer patients. Qual Life Res 2007;16:509-22.

Kulasegarah J, Lang EE, Carolan E, Viani L, Gaffney R, Walsh RM. Day of surgery admission – is this safe practise? IMJ 2008;101:218-9.

Kwon AH, Matsui Y. Laparoscopic cholecystectomy in patients aged 80 years and over. World J Surg 2006;30:1204-10.

Laffel G, Blumenthal D. The case for using industrial quality management science in health care organizations. JAMA 1989;262:2869-73.

Lahtinen J, Valanne J. Kenelle päiväkirurgia soveltuu? Suom Lääkäril 1998;53:543-7. (In Finnish)

Langenbuch C. Ein fall von extirpation der gallenblase wegen chronischer cholelithiasis. Heilung. Berlin Klein Wochenschr 1882;19:725-7. (In Germany)

Lee A, Lum ME, Perry M, Beehan SJ, Hillman KM, Bauman A. Risk of unanticipated intraoperative events in patients assessed at a preanaesthetic clinic. Can J Anaesth1997;44: 946-54.

Lee JA. The anesthetic outpatient clinic. Anesthesia 1949;4:169-74.

Lemmens LC, vanKlei WA, Klazinga NS, Rutten CLG, van Linge RH, Moons KGM, Kerkkamp HEM. The effect of national guidelines on the implementation of outpatient preoperative evaluation clinics in Dutch hospitals. Eur J Anaesthesiol 2006;23:962-70.

Lemmens LC, Kerkkamp HE, van Klei WA, Klazinga NS, Rutten CL, van Linge RH,Moons KG. Implementation of outpatient preoperative evaluation clinics: facilitating and limiting factors. Br J Anaesth 2008;100:645-51.

Lew E, Pavlin DJ, Amundsen L. Outpatient preanaesthesia evauation clinics. Singapore Med J 2004;45:509-16.

Lindfors PM, Nurmi KE, Meretoja OA, Luukkonen RA, Viljanen AM, Leino TJ, Harma MI. On-call stress among Finnish anaesthetists. Anaesthesia 2006;61:856-66.

Lindqvist R, Stenbeck M, Diderichsen F. Does hospital discharge policy influence sick-leave patterns in the case of female breast cancer? Health policy 2005;72:65-71.

Macario A, Vitez TS, Dunn B, McDonald T. Where are the costs in perioperative care? Analysis of hospital costs and charges for inpatient surgical care. Anesthesiology 1995;83:1138-44.

Marla S, Stallard S. Systematic review of day surgery for breast cancer. Int J Surg 2009;7:318-23.

Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection. Infect Control Hosp Epidemiol 1999;20:247-64.

Mangran JL, Walsch C, Kernohan WG, Murphy JS, Mollan RA, McMillen R, Beverland DE. Total joint replacement: implication of cancelled operations for hospital costs and waiting list management. Qual Health Care 1992;1;34-7.

Mattila K, Hynynen M, Insentium Consortium Study Group. Day surgery in Finland: a prospective cohort study of 14 day-surgery units. Acta Anaesthesiol Scand 2009;53:455-63.

Mattila K, Vironen J, Eklund A, Kontinen VK, Hynynen M. Randomized clinical trial comparing ambulatory and inpatient care after inguinal hernia repair in patients aged 65 years or older. Am J Surg 2011;201:179-85.

Ministry of Social Affairs and Health 2010. Uniform criteria for access to non-emergency treatment 2010. Reports of the Ministry of Social Affairs and Health 2010:33.

Moock J, Kohlmann T. Comparing preference-based quality-of-life measures: results from rehabilitation patients with musculoskeletal, cardiovascular, or psychosomatic disorders. Qual Life Res 2008;17:485-95.

Musser DJ, Calligaro KD, Dougherty MJ, Raviola CA, DeLaurentis DA. Safety and cost-efficiency of 24-hour hospitalisation for carotid endarterectomy. Ann Vasc Surg 1996;10:143-6.

National Institute for Health and Welfare 2012. Access to care in secondary health care, statistics 30.4.2012. https://sampo.thl.fi/select?area=ESHjono (accessed in July 2012)

NHS Modernisation Agency. 10 High impact changes for service improvement and delivery: a guide for NHS Readers. London: NHS Modernisation Agency 2004:15-84.

Nicoll JM. The surgery infancy. BMJ 1909;753-6.

Nordin P, Zetterström h, Carlsson P, Nilsson E. Cost-effectiveness analysis of local, regional and general anaesthesia for inguinal hernia repair using data from a randomized controlled trial. Br J Surg 2007;94:500-5.

Oppedal K, Møller AM, Pedersen B, Tønnesen H. Preoperative alcohol cessation prior to elective surgery. Cochrane Database Syst Rev 2012;7:CD008343.

Ortiga B, Capdevilla C, Salazar A, Viso MF, Bartolomé C, Corbella X. Effectiveness of a surgery admission unit for patients undergoing major elective surgery in a tertiary university hospital. BMC Health Serv Res 2010;10:23.

Parker BM, Tetzlaff JE, Litaker DL, Maurer WG: Redefining the preoperative evaluation process and the role of the anesthesiologist. J Clin Anesth 2000;12:350-6.

Parsons DP. Preoperative evaluation and risk management. Clin Colon Rectal Surg 2009;22:5-13.

Plesk PE. Systematic design of healthcare processes. Qual Health Care 1997;6:40-8.

Pollard JB, Zboray AL, Mazze RI. Economic benefits attributed to opening a preoperative evaluation clinic for outpatients. Anesth Analg 1996;83:407-10.

Pollard JB, Garnerin Ph, Dalman RL. Use of outpatient preoperative evaluation to decrease length of stay for vascular surgery. Anesth Analg 1997;85:1307-11.

Pollard JB, Olson L. Early outpatient preoperative anesthesia assessment: Does it help to reduce operating room cancellations? Anesth Analg 1999;89:502-5.

Pollit C. Business approaches to quality improvement: why they are hard for NHS to swallow. Qual Health Care 1996;5:104-10.

Portincasa P, Moschetta A, Palasciano G. Cholesterol gallstone disease. Lancet 2006;368:230-9.

Portincasa P, Di Ciaula A, Bonfrate L, Wang DHQ. Therapy of gallstone disease: what it was, what it is, what it will be. World J Gastrointest Pharmacol Ther 2012;3:7-20.

Posnett J, Jan S. Indirect cost in economic evaluation: the opportunity costs of unpaid inputs. Health Econ 1996;5:13-23.

Rao SV, Kaltenbach LA, Weintraub WS, Roe MT, Brindis RG, Rumsfeld JS, Peterson ED. Prevalence and outcomes of same-day discharge after elective percutaneous coronary intervention among older patients. JAMA 2011;306:1461-7.

Rawlins MD, Culyer AJ. National Institute for Clinical Excellence and its value judgements. BMJ 2004;329:224-7.

Rawlins MD. 5 NICE years. Lancet 2005;365:904-8.

Rissanen P, Aro S, Sintonen H, Slätis P, Paavolainen. Quality of life and functional ability in hip and knee replacements: a prospective study. Qual Life Res 1996;5:56-64.

Roizen MF. Cost-effective preoperative laboratory testing. JAMA 1994;271:319-20.

Robinson R. Cost-effectiveness analysis. BMJ 1993;307:793-5. (1)

Robinson R. Cost-utility analysis. BMJ 1993;307:859-62. (2)

Robinson R. Cost-benefit analysis. BMJ 1993;307:924-6. (3)

Räsänen P, Roine E, Sintonen H, Semberg-Konttinen V, Ryynänen O-P, Roine RP. Use of quality-adjusted life years for the estimation of effectiveness of health care: a systematic literature review. Finohta´s report 2006;29.

Sáez-Castillo AJ, Olmo-Jiménez MJ, Pérez Sánchez JM, Negrin Hernández MA, Arcos-Navarro A, Diaz-Oller J. Bayesian analysis of nosocomial infection risk and length of stay in a department of general and digestive surgery. Value Health 2010;13:431-9.

Sager M, Franke T, Inouye S, Landefeld C, Morgan T, Rudberg M. Functional outcomes of acute medical illness and hospitalisation in older persons. Arch Int Med 1996;156:645-8.

Salazar A, Estrada C, Porta R, Lolo M, Tomas S, Alvarez M. Home hospitalization unit: an alternative to standard inpatient hospitalization from the emergency department. Eur J Emerg Med 2009;16:121-3.

Sanjay P, Dodds A, Miller E, Arumugam PJ, Woodward A. Cancelled elective operations: an observational study from a district general hospital. J Health Organ Manag 2007;21:45-8.

Saviteer S, Samsa G, Rutala W. Nosocomial infections in the elderly – increased risk per hospital day. Am J Med 1988;84:661-6.

Schiff JH, Frankenhauser S, Pritsch M, Fornaschon SA, Snyder-Ramos SA, Heal C, Schmidt K, Martin E, Böttiger BW, Motsch J. The anesthesia preoperative evaluation clinic (APEC): a prospective randomized controlled trial assessing impact on consultation time, direct costs, patient education and satisfaction with anesthesia care. Minerva Anestesiol 2010;76:491-9.

Schofield WN, Rubin GL, Piza M, Lai YY, Sindhusake D, Fearnside M, Klineberg P. Cancellation of operations on theday of intended surgery at a major Australian referral hospital. MJA 2005;182:612-5.

Schuster M, Neumann C, Neumann K, Braun J, Geldner G, Martin J, Spies C, Bauer M. The effect of hospital size and surgical service on case cancellation in elective surgery: results from a prospective multicenter study. Anesth Analg 2011;113:578-85.

Serra-Prat M, Gallo P, Picaza JM. Home palliative care as cost-saving alternative: evidence from Catalonia. Palliat Med 2001;15:271-8.

Shamiyeh A, Wayand W. Current status of laparoscopic therapy of cholecystolithiasis and common bile duct stones. Dig Dis 2005;23:119-26.

Sintonen H. The 15D instrument of health-related quality of life: Properties and applications. Ann Med 2001;33:328-36.

Skattum J, Edwin B, Trondsen E, Mjaland O, Raeder J, Buanes T. Outpatient laparoscopic surgery: feasibility and consequences for education and health care costs. Surg Endosc 2004;18.796-801.

Smith I, Cooke T, Jackson I, Fitzpatrick R. rising to the challenges of achieving day surgery targets. Anaesthesia 2006;61:1191-9.

Soini E, Keränen J, Ryynänen O-P, Keränen U. Leikkaukseen kotoa (LEIKO) -toimintamalli on hyödyllinen – Tapahtumaperusteinen kustannus-utiliteetti-, kustannus-vaikuttavuus- ja riski-hyötyanalyysi. Podium. In: Klavus J (ed.) Terveystaloustiede 2007. Helsinki: STAKES, 36–42. (In Finnish)

Stakes 2008. Nordic alcohol statistics 2002-2007. National Research and Development Centre for Welfare and Health: Statistical summary 18/2008.

Starsnic MA, Guarnieri DM, Norris MC. Efficacy and financial benefit of an anesthesiologist-directed university preadmission evaluation center. J Clin Anesth 1997;9:299-305.

Stavem K. Realibility, validity and responsiveness of two multiattribute utility measures in patients with chronic obstructive pulmonary disease. Qual life Res 1999;8:45-54.

Taheri PA, Butz Da, Greenfield LJ. Length of stay has minimal impact on the cost of hospital admission. J Am Coll Surg 2000;191:123-30.

Tait AR, Voepel-Lewis T, Munro HM, Gutstein HB, Reynolds PI. Cancellation of pediatric outpatient surgery: economic and emotional implications for patients and their families. J Clin Anesth 1997;9:213-9.

Tenconi SM, Boni L, Colombo EM, Dionigi G, Rovera F, Cassinotti E. Laparoscopic cholecystectomy as day-surgery procedure: current indications and patients´ selection. Int J Surg 2008;6:86-8.

Tessler MJ, Mitmaker l, Wahba RM, Covert HM. Patient flow in the postanesthesia care unit: an observational study. Can J Anaesth 1999;46:348-51.

Tolonen P, Victorzon M, Makelä J. Impact of laparoscopic adjustable gastric banding for morbid obesity on disease-specific and health-related quality of life. Obes Surg 2004;14:788-95.

Traverso LW. Carl Langenbuch and the first cholecystectomy. Am J Surg 1976;132:81-2.

Trentman TL, Mueller JT, Fassett SL, Dormer CL, Weinmeister KP. Day of surgery cancellations in a tertiary care hospital: a one year review. J Anesthe Clinic Res 2010; 1:109. doi:10.4172/2155-6148.1000109

Tung A, Dexter F, Jakubczyk S, Glick DB. The limited value of sequencing cases based on their probability of cancellation. Anesht Analg 2010;111:749-56.

van Klei WA, Moons KGM, Rutten CLG, Schuurhuis A, Knaoe JTA, Kalkman CJ, Grobbee DE. The effect of outpatient preoperative evaluation ofhospital inpatients on cancellation of surgery and length of hospital stay. Anesth Analg 2002;94:644-9.

Vogel TR, Dombrovskiy VY, Lowry SF. In-hospital delay of elective surgery for high volume procedures: the impact on infectious complications. J Am Coll Surg 2010;211:784-90.

Vogt AW, Henson LC. Unindicated preoperative testing: ASA physical status and financial implications. J Clin Anesth 1997;9:437-41.

Warner MA, Shields SE, Chute CG. Major morbidity and mortality within 1 month of ambulatory surgery and anesthesia. JAMA 1993;270:1437-41.

Watanabe A, Kohnoe S, Shimabukuro R, Yamanaka T, Iso Y, Baba H, Higashi H, Orita H, Emi Y, Takahashi I, Korenaga D, Maehara Y. Risk factors associated with surgical site infection in upper and lower gastrointestinal surgery. Surg Today 2008;38:404-12.

Weinstein R. Nosocomial infection update. Emerg Infect Dis 1998;4:416-20.

Whitehouse JD, Friedman ND, Kirkland KB, Richardson WJ, Sexton DJ. The impact of surgical-site infections following orthopedic surgery at a community hospital and a university hospital: adverse quality of life, excess length of stay, and extra cost. Infect Contr Hosp Epidemiol 2002;23:183-9.

Wiebe S, Guyatt G, Weaver B, Matijevic S, Sidwell C. Comparative responsiveness of generic and specific quality-of-life instruments. J Clin Epidemiol 2003;56:52-60.

Wilmore DW, Kehlet H. Management of patients in fast track surgery. BMJ 2001;322:473-6.